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IN MEMORIAM

DR. JOHN WHITRIDGE WILLIAMS

1866-1931

ON OCTOBER twenty-first American medicine lost one of its most outstanding figures, for on that evening occurred the death of John Whitridge Williams, revered and loved by American and European obstetricians and gynecologists, and respected and admired by the entire profession. The shock of his sudden and unexpected death has cast a shadow over Johns Hopkins and over his immediate associates, and has kept them from a full realization of their tremendous loss. One cannot write of him as of one who belongs to the past; his overwhelming personality and far reaching influence seem as real today as ever before.

Dr. Williams was born in Baltimore, January 26, 1866, the son of Doctor Philip C. and Mary C. Whitridge Williams. His grandfather, Dr. John Whitridge, settled in Baltimore in 1820, while his great-grandfather, Dr. William Whitridge, began the practice of medicine in Rhode Island in 1770. At the age of twenty Dr. Williams graduated from Johns Hopkins University with a bachelor of arts degree, and at twenty-two he received his medical degree from the University of Maryland. In 1888, soon after graduation, he went to Europe to attend universities in Berlin, Leipzig, Prague, Vienna and Paris. On his return he joined Dr. Howard A. Kelly's department and in 1893 was appointed professor of obstetrics at John Hopkins; six years afterward he was made Obstetrician-in-chief to the Hospital. Later he succeeded Dr. Howell as dean of the medical school and functioned in this capacity for thirteen years, resigning in 1923 in order to devote all his time and energy to his chief interest, the Woman's Clinic.

His contributions to the science of obstetrics are too well known to the readers of this JOURNAL to need further elaboration. It may suffice to mention his outstanding and revolutionary work in syphilis during pregnancy, his fundamental studies in placental infarcts, his publications on chorioepithelioma, his pioneer work in antenatal care, and his studies on contracted pelvis and pelvimetry in general.

His conservative teachings in the use of cesarean section and his profound knowledge of and contributions to obstetric pathology are best illustrated in his most recent work on the postpartum changes in the uterus at the site of the placental implantation which was presented last May before the American Gynecological Society, of which he was President in 1913. One cannot refrain from mentioning his well-known textbook on obstetrics, which so well exemplifies his scientific mind; in his treatment of obstetrics as a biologic science he did not allow the clinical aspect to suffer.

Of his personality and character much could be written. He was a sensitive man, so sensitive indeed that to the outside world he gave the impression of gruffness. But no one who knew of his kindly acts, especially toward needy students and younger graduates, ever doubted that the manner was but the mask of an extraordinarily generous spirit. He was a tireless worker and established a routine for every day, week and month, from which he very seldom swerved, and which, according to his assertion, he built up to overcome his own inertia. With a profound dislike for personal publicity he combined a modest appreciation of the personal compliments of those he respected and liked, and was always accessible to his associates and friends.

No estimate of Dr. Williams would be complete without touching upon his qualities entirely unrelated to medicine. He was eminently a citizen of strong convictions and a gentleman of the older tradition in which he grew up. He believed in local as opposed to national government and was ready at all times to support the State as against federal authority. He had no belief in the virtues of the material or mechanical devices with which the modern age abounds and, in fact, maintained firmly that a better life was actually realized by people under the simple conditions prevailing in his youth than in the complex conditions of today, overloaded with radios, movies, labor-saving devices and jaded nerves.

The tradition in which Dr. Williams grew up required that a gentleman should be educated, and education for him included not merely a working knowledge of a single science, but a broad interest in literature, an ability to write the English language well, a familiarity with other languages, and a sense of history. A lover of old books, he made a collection of ancient medical works which he bequeathed to Johns Hopkins University. Within the last three years he spent a considerable part of his vacation in perfecting his Latin, in order to read more fluently certain old treatises which he had acquired.

In conversation he was a most welcome companion. While his tendency was to listen, his keen appreciation of many subjects made him a most trenchant and often a most spicily humorous critic. His was a personality which combined a strong intellect with a strong body and a strong will. Masculinity and power radiated from him and all who knew him felt his profound honesty and were inspired by his un-

daunted striving toward that goal which seemed to him to be the right one. Of all his qualities this dynamic sincerity was one of his most salient characteristics.

His first care on taking charge of the department of obstetrics at the Johns Hopkins Hospital was to organize and develop it along scientific lines, to reproduce in his wards all of the inquiring spirit which had placed German medicine in the lead. One of his life ambitions was to build up at the Hopkins a complete Woman's Clinic, or "Frauenklinik." In this he was successful and American obstetrics must acknowledge a great debt to him.

Perhaps the most noteworthy contribution made by Dr. Williams, as dean of Johns Hopkins, was his backing and support of the full-time principle for the teaching staff of the Medical School. No move of his aroused more opposition, but no move aroused more enthusiasm among his friends and supporters. The controversy still lives; nevertheless "full time" is established, however modified it may be in detail. As a principle it appears to have earned a permanent place in medical schools of the first rank.

Dr. Williams himself would have been the first man to deny that he had himself effected these changes. He was strongly supported by his colleagues, but his was the moving spirit, the energy that bound his friends together and made it possible to carry through these plans.

Dr. Williams, together with the other members of that group of men who shaped the early life of the Johns Hopkins Medical School, brought world-wide fame and distinction to that institution. As the years roll by this group is gradually dwindling in number, and we of the younger generation wonder whether their places can ever be filled. It was truly a unique group, to which medicine owes a debt that can never be paid and the name of Dr. Williams is permanently written in its annals and in the annals of obstetrics. May his great personality, his intellectual courage and honesty, and his scientific spirit not die, but lead his successors and his pupils to carry on the work which he began.

—H. J. Stander.

To the foregoing memorial of Dr. Williams by one of his associates and coworkers, the editors of the JOURNAL desire to add an expression of their personal appreciation of his deep interest in this publication. He was a frequent contributor to its pages and what we believe to be his last scientific paper is included in the present issue. Dr. Williams was an active member of the Executive Committee of the Advisory Editorial Board of the JOURNAL since its organization and was always ready with valuable counsel and practical help when called upon. The JOURNAL has been honored by this association with a man whose achievements in obstetrics have been outstanding and whose exalted position in the annals of American medicine is assured.

Original Communications

REGENERATION OF THE UTERINE MUCOSA AFTER DELIVERY, WITH ESPECIAL REFERENCE TO THE PLACENTAL SITE*

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ACCURATE statements concerning the process of regeneration following labor could not be expected until the nature of the decidual lining of the uterus was clearly understood, nor until histologic technic had become so developed as to make possible preparations which could not be misinterpreted.

In general, our knowledge may be said to start with the fundamental monograph of Friedländer written in 1870, although William Hunter a century previously had stated "that the decidua is an efflorescence of the inner coat of the uterus itself, and is therefore shed as often as the woman bears a child or suffers a miscarriage. It is of considerable thickness, and one stratum of it is always left upon the uterus after delivery, most of which dissolves and comes away with the lochia." Such views, however, did not obtain universal acceptance, as is indicated by the fact that Cruveilhier, Dubois and others taught that the entire lining of the uterus was thrown off at the time of labor, leaving the muscle exposed. More accurate knowledge slowly developed, and Coste and Robin in the fourth decade of the last century thought that a new mucosa began to develop during the fourth month of pregnancy, and took the place of the old one after delivery. Furthermore, they taught that the cervical mucosa was never cast off.

Heschl in 1852 studied in some detail the processes involved in the involution of the puerperal uterus, but knew little about the regeneration of its mucosa. In general, he held that it was not completed until the uterus had returned to its original size, and that regeneration of the placental site required still longer. He stated that the latter was characterized by the presence of large thrombosed vessels and was the size of a "thaler" at the sixth week. Furthermore, he noted that "the vessels which lie in the depths of the uterus are distinguishable for a long time, and perhaps for ever, by their thick walls and large size." Consequently, he may be regarded as having begun the controversy

*Read in abstract before the American Gynecological Society, May 18, 1931.

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which has continued to the present time, concerning the nature of the vascular changes which occur during and after pregnancy. It might also be noted that Matthews Duncan in 1863 revived the Hunterian views in England.

As has already been indicated, our knowledge really started with Friedländer, who in 1870 accurately described the decidua with its compact and spongy layers, and pointed out that at the time of labor separation occurred in the deeper part of the former, so that the entire spongy layer was retained, from the fundi of whose glands the new mucosa is restored. He also demonstrated that outside of the placental site the mucosa was completely restored by the fourth week, but not until several weeks later at the placental site. He pointed out that the essential feature of the latter consisted in the presence of thrombosed vessels which undergo organization, and he believed that the process originated during the last weeks of pregnancy as the result of hyalin degeneration of the walls of the vessels in the decidua basalis, which were invaded by fetal cells. He apparently, however, had no idea as to how the organized thrombi were eventually gotten rid of.

In 1873 appeared the article of Kundrat and Engelmann, which is of interest from several points of view. In the first place the authors recognized the fact that the uterine mucosa is constantly undergoing a series of cyclical changes, and so almost anticipated the work of Adler and Hitschmann upon which our current views are so largely based. In the second place, by the study of a large number of specimens, they made a fundamental contribution to the changes which occur in the decidua during pregnancy and the puerperium. They showed that outside of the placental site the uterine mucosa becomes completely regenerated during the third week of the puerperium, at which time the placental site is not yet covered by epithelium. Furthermore, it is interesting to note that with the exception of a trifling contribution by Wheeler, Engelmann is the only American who has contributed to the subject under discussion.

In 1875, Langhans, to whom we are indebted for much information concerning the placenta, pointed out that the decidua really consists of three layers, and that, in addition to the two layers described by Friedländer, there is a third or basal layer immediately adjoining the muscularis, in which the glands and stroma cells preserve their pregravid structure. Furthermore, he insisted that at the time of labor separation occurred in the spongy layer, and not in the compacta as Friedländer believed, so that part of the spongy and all of the basal layer remain in situ, and that it is in great part from the latter that the new mucosa is derived. He contended that regeneration occurs in the same way at the placental site, so that one does not have to deal with a raw wound, but rather with a surface in great part covered by epithelium.

A year later, DeSinéty wrote upon the subject, and, while admitting that the uterus after delivery was lined by decidua, he contended that it contained no glands nor epithelial structures. Accordingly, he was compelled to assume that the epithelial cells of the regenerated mucosa had developed from embryonic cells.

In 1878 Leopold's *Studies on the Uterine Mucous Membrane* appeared, which, together with Friedländer's monograph, constituted the basis of our knowledge for many years. It consisted of three parts, the third of which, dealing with the changes in the mucosa during the puerperium, is of particular interest to us. Leopold agreed with Friedländer that during the eighth month of pregnancy many vessels at the placental site undergo hyalin change and are invaded by serotinal giant cells, which lead to complete or partial thrombosis, and he believed that the resulting interference with circulation played an important part in the causation of labor. After expulsion of the placenta, these vessels constitute a part of the thrombi which characterize its site, while additional thrombi develop during the first days of the puerperium. Both become organized, and are broken up into smaller and smaller portions by invading vessels and eventually disappear.

Outside of the placental site, he held that the superficial part of the retained decidua underwent necrosis and was cast off, while the new mucosa was regenerated from the glandular epithelium and stroma cells which remained, the process being completed during the third week. As he could not see mitotic figures, he held that cell division must occur by the direct method. At the placental site, regeneration was not completed until the sixth week, and as very few glands remained in the decidua basalis, he held that new ones were derived from serotinal cells, which had extended between the muscle bundles. Careful study of this valuable monograph failed to show that Leopold had any idea of such exfoliation of the placental site, as will be described in the latter part of this article.

The following year, Patenko wrote upon "the physiological thrombosis of the uterine vessels during pregnancy," and held that the cells which Friedländer and Leopold had observed in the uteroplacental vessels were derived from endothelium, and consequently were not fetal or serotinal giant cells. This article is of interest, as it represents the first of a large series having to do with a question which has not yet been settled.

In 1887 Mayor contributed a histologic study on uterine involution, and, while it was chiefly concerned with the changes occurring in the muscularis, it contained several statements of interest in connection with our problem. In the first place, he was one of the first writers to mention changes in the elastic tissue of the uterine vessels, which persist long after labor. Furthermore, he held that regeneration of the mucosa was not completed until the second month, and even so

late as the twenty-fourth day postpartum that he was unable to find a gland at the placental site. Finally, he stated that unless studies were made upon normal uteri, the conclusions would probably be incorrect.

The same year Peter Müller voiced a similar complaint, and held that our imperfect knowledge concerning the changes at the placental site was due to the fact that most of the specimens studied had been obtained from women who had died from infection. He predicted that the problems would not be solved until a series of specimens was obtained from normal women, and one of the objects of the present paper will be to fill that lack.

Klein in 1891 wrote a long-winded article upon the decidua, and, while he said nothing about the placental site, stated that the new mucosa was regenerated from fragments of decidua included in the interstices between the muscle bundles, and held that it might occur as early as the third day postpartum. On the other hand, he stated that following abortions no tissue was cast off, but that the necrotic material was absorbed and what was left became converted into normal mucosa within five or six weeks.

One of the most important early articles came from Emil Ries of the Strassburg Clinic in 1892. Its first part dealt with clinical observations concerning involution of the uterus, the patency of the cervix and the persistence of the lochia and does not especially concern us. The second part was based upon the palpation of the placental site in 36 normal women up to the twelfth day postpartum, as well as upon the histologic examination of tissue removed by means of the finger. Ries pointed out that the irregular surface of the placental site is due to projecting thrombi, and that upon microscopic examination muscle cells, decidual cells, glands, and obstructed vessels with hyalin walls could be found. On page 85 he described the fate of the placental site as follows: "When the placenta separates many vessels are opened up, which were already more or less thrombosed, but which still contain blood. A portion of this blood does not immediately escape, and finds in the existing thrombi sufficient substances to cause coagulation. A certain 'nutrient stream' in small spaces hinders the immediate casting off of the clots, which is eventually brought about by epithelium from glands gradually spreading over the surface, and by the glands beginning to secrete again, so that eventually a layer forms between the mucosa and the clot, detaches it from its base and causes its exfoliation, often in masses of considerable size."

As will be seen later, this description is suggestive of the mechanism which I shall describe, and is unique as far as I can find in my survey of the literature. The fact, however, that Ries' observations ceased on the twelfth day postpartum necessarily makes them far from complete,

and he emphasizes the necessity for obtaining specimens from uninfected and normal women.

The same year Webster published his *Researches in Female Pelvic Anatomy,* in which he described a number of early puerperal uteri, and gave excellent gross pictures of the placental site. However, as nothing was said regarding their histologic structure, his observations are valueless for our problem.

In 1895, Werth made his important contribution upon the regeneration of the uterine mucosa after curettage. This was based upon the histologic examination of uteri extirpated at varying periods after that operation. He noted the extreme rapidity with which the new mucosa is regenerated, and demonstrated that it was effected by the proliferation of the tissue left in the interstices between the various muscle bundles. Werth's investigations were of fundamental importance and will be referred to again.

During the next few years articles appeared from Pels Leusden, D'Erchia, and Aschoff on the part played by the so-called serotinal giant cells in the regeneration of the placental site. The former directed attention to the giant cells which are found in the decidua basalis and in the superficial portion of the muscularis beneath the placental site throughout pregnancy and during the first part of the puerperium, but which usually disappear after the first week. Leusden held that there were practically no glands in the decidua basalis, and that the giant cells play an important part in affording a basis for the glandular structures which later develop. D'Erchia strongly opposed that view, but in other respects his article is of interest only in the fact that the subsequent investigation has proved that practically every statement he made was incorrect. On the other hand, Aschoff's article has stood the test of time. He held that the syncytial giant cells are of fetal and not maternal origin, and take no part in the formation of glands at the placental site. Furthermore, he contended that there are always sufficient glands in the retained portion of the decidua basalis to effect regeneration, and consequently that it was unnecessary to seek other explanations for their production. In other respects, his article does not affect our problem, as he did not take into consideration the mode by which the placental site eventually disappears.

In 1901 Krönig published an important article upon placentation and the behavior of the uterine mucosa during the early puerperium, which was based upon normal material and was well illustrated. He pointed out that while separation of the placenta and membranes usually occurs in the spongy layer of the decidua, yet it does not occur as schematically as described in the literature; he showed that the amount of decidua retained varies greatly, consisting in some places only of a few layers of cells, while in others portions of spongy layer

measuring several millimeters in thickness are retained. He insisted that at the placental site enough mucosa is always retained to insure regeneration of the new membrane, while in the cervical region the mucosa remains practically intact. He held that regeneration of the main uterine mucosa is completed by the eighteenth day, but requires a longer time at the placental site. Naturally, he mentioned thrombosed vessels in the latter location, but gave no information as to how they are eventually gotten rid of. Furthermore, he gave an excellent picture of the chorionic giant cells in and beneath the placental site, and expressed the opinion that they usually disappear by the fifth day of the puerperium. Finally, he held, contrary to most writers, that puerperal infection does not interfere with or delay the regeneration of the mucosa.

The following year Wormser's long article appeared, which was based upon the examination of 7 uteri, and of tissue removed from 36 women by curettage, and from 4 others by manual removal of material from the placental site. He held that regeneration outside of the placental site was usually complete by the fourteenth to seventeenth day, and directed attention to peculiar degenerative changes occurring in the epithelium, as well as to the absence of mitosis for at least the first two weeks. He mentioned the thrombosed vessels at the placental site without details as to their disappearance, but in general he gave the impression that its regeneration was effected in essentially the same manner as elsewhere.

In the literature Wormser's article is generally regarded as being very fundamental, but, except for the fact that a more refined histologic technic was employed, his findings scarcely appear superior to those of Friedländer, Leopold, or Ries.

The subject lay fallow for the next seven years, until the appearance of Goodall's monograph in 1910, which was followed in quick succession by contributions by Frankl and Stolper, Schickele, Hinselmann and others. All of these articles dealt with the vascular changes occurring at the placental site, as well as elsewhere in the uterine wall, and it would lead too far afield to attempt to discuss them in detail, as they have only an indirect bearing upon our problem.

Goodall's extensive monograph on the involution of the puerperal uterus was in great part confined to the study of the uterine vessels by means of Van Gieson's and Weigert's elastic stain. He believed that as a result of the greatly diminished need for blood after delivery all the vessels of the puerperal uterus undergo important changes, and particularly those in the inner and middle thirds of the muscularis, and particularly beneath the placental site. He holds that all of the arteries are renewed after each pregnancy, and that this is effected by the building of a new and much smaller vessel within the lumen of the old one. Following this, the rest of the vessel undergoes

hyalin and elastoid degeneration and in young women is rapidly and entirely resorbed, whereas in older women the process is slower and less complete. While Goodall's study has added materially to our knowledge of involution of the uterus, I do not believe that it tells the entire story, as I am confident that many vessels become entirely obliterated and absorbed, without the formation of new ones in their interior.

Schickele limited his study to the changes occurring in vessels at or near the placental site. He pointed out that as the result of invasion by trophoblastic cells their walls undergo hyalin degeneration and thereby become more plastic. As a result, they are more readily compressed by the contracting and retracting muscle whereby hemostasis is assured, and at the same time the way is prepared by their eventual absorption. Such a process, of course, differs materially from the sclerotic changes described by Pankow, Goodall and others, and he held that it constitutes an essential feature in the story of the placental site.

Hinselmann's voluminous article, which is profusely and excellently illustrated, deals with the "so-called physiologic thrombosis of vessels at the placental site." He holds that thrombosis does not occur early in pregnancy and that what has been described as such is due to thrypsis and rarefication of maternal tissue resulting from the action of some substance derived from fetal elements. On the other hand, he contends that the cells so frequently present in the lumina of the vessels cannot possibly be of fetal origin, and consequently must be maternal. To my mind, the important feature of his article is the insistance that such changes involve veins as well as arteries, so that the nature of a given vessel can be determined only by tracing it outward from the placental site and ascertaining its original nature.

The World War interfered with researches of this character, so that, with the exception of several articles dealing with vascular changes, no important further contribution was made until Teacher wrote *On Involution of the Uterus Postpartum* in 1927. In this article he devoted considerable attention to the regeneration of the mucosa and stated that it is completed during the third week outside of the placental site, and during the sixth week in the latter location. He held that the characteristic nodulated appearance of the placental site is due to thrombosis, which affects veins as well as arteries, and after organization the thrombi gradually disappear in situ; at least he did not mention their exfoliation. He devoted some attention to the time of disappearance of the chorionic giant cells, particularly on account of their importance in the diagnosis of chorionepithelioma; and finally called attention to the presence of pigment bearing phagocytes. In general, the article is of importance, as it demonstrates that the author had considerable personal experience with the problems involved.

Finally, the last important contribution is the section on "the uterus in the puerperium" written by R. Schroeder in Moellendorff's Handbuch in 1930. He states that outside of the placental site regeneration is effected early in the third week, but in the latter location the presence of thrombosed and hyalin vessels interferes materially with the development of an epithelial covering. He is not clear about the fate of the vessels, and states that "for the first few weeks the placental site is mainly recognizable by the presence in the inner third of the muscularis of giant cells derived from chorionic epithelium. Later they disappear, and for the next few months to a year the hyalin masses and bands about the vessels constitute the characteristic feature. Within a few months they likewise disappear, when the only evidence of the gestational activity of the uterus is afforded by the final vascular sclerosis."

From this quotation it appears that Schroeder assumes that the thrombosed vessels are absorbed in situ, and that he had no idea that they are exfoliated as will be demonstrated later. It is interesting to note that he, like many others, states that no mitoses are observed during the first two weeks and that the cervical mucosa is practically restored by the end of the first week.

Other articles dealing with the subject were written by Fehling, Rathcke, Broers, Jaschke, and Labhardt, but, as they give no evidence of being based upon first-hand study, it is necessary only to refer to them. Furthermore, it might be mentioned that, in addition to the articles already cited, many other writers have taken part in the discussion started by Patenko concerning the nature of the vascular changes occurring during pregnancy and the puerperium and have expressed the most divergent and contradictory views. As it would lead too far afield to consider them in detail, I shall content myself with mentioning their names: Balin 1880, Dittrich 1890, Broers 1895, Pankow 1906, Bucura 1910, Frankl and Stolper 1910, Büttner 1911, Heckner 1912, Schwarz 1923, and Wermbter 1925.

From this somewhat lengthy summary several points become apparent:

I. That from the time of Friedländer most authors agree that regeneration of the uterine mucosa outside of the placental site is practically completed during the third week after delivery.

II. That during the first two weeks of the process no one has observed mitotic figures in the uterine epithelium.

III. That the cervical mucosa is essentially restored by the end of the first week.

IV. That the gross features of the placental site have been known for years, and that it practically disappears six or seven weeks postpartum.

V. That no one is conversant with the finer changes concerned in

its disappearance, and that no writer, with the exception of Ries, had any idea that the thrombosed vessels might be exfoliated instead of being resorbed in situ.

VI. That the greatest confusion still exists concerning the character and origin of the vascular changes which occur during pregnancy and the puerperium.

VII. That the probable cause of much of the uncertainty is attributable to lack of well-preserved normal material.

The purpose of the present study is to present my observations on the regeneration of the uterine mucosa during the puerperium, more particularly in relation to the changes occurring at the placental site. They are based upon the study of a large series of uteri removed by supravaginal amputation following cesarean section, as well as a certain number obtained at autopsy upon women dying from other causes than infection during the first three days of the puerperium, and upon others removed by operation during that period, but especially upon a series of eighteen uteri obtained by supravaginal amputation at various periods throughout the puerperium.

In the first group, some of the uteri were removed before and others after the extrusion of the placenta, thereby affording an opportunity for studying the conditions at the very end of pregnancy and the first minutes of the puerperium. It is scarcely necessary to add that the preservation of our specimens was ideal, as they were immediately placed in 10 per cent formalin in the operating room.

The autopsy specimens were obtained from women dying from pneumonia, heart disease, or some form of toxemia within a few hours to three days after delivery. Accordingly, they offer a material for the study of the gross appearance and microscopic structure of the early placental site, without being complicated by the presence of lesions associated with puerperal infection, as was generally the case with previous writers.

Finally, the series of uteri amputated during the puerperium offers an unsurpassed material for the study of the changes occurring between the end of the first week and the conclusion of the puerperium. This consists of eighteen uteri which were removed from uninfected women at the following stages of the puerperium:

Seventh	day, one specimen	Twenty-first	day, two specimens
Eighth	day, two specimens	Twenty-fourth	day, one specimen
Ninth	day, one specimen	Twenty-sixth	day, one specimen
Twelfth	day, one specimen	Forty-first	day, one specimen
Fourteenth	day, one specimen	Forty-eighth	day, one specimen
Sixteenth	day, one specimen	Fifty-first	day, one specimen
Seventeenth	day, one specimen	Three months,	one specimen
Twentieth	day, one specimen	Four months,	one specimen

These uteri, without the appendages, were removed for the purpose of sterilization on account of chronic nephritis, serious heart disease,

pronounced feeble-mindedness, and other psychiatric indications after the necessity for interference had been explained to the patient and her family and the necessary legal consent obtained in writing. Whether sterilization was effected in this way or by some operation upon the tubes depended upon the feelings of the patient, who was informed that one type of operation would be followed by the cessation of menstruation and the other by its continuance, and the choice was made in accordance with her expressed desire. In this connection, I noted with interest that colored women appeared to lay less stress upon the preservation of the menstrual function, while in white women the desire for its continuation appears to be in inverse proportion to their intelligence.

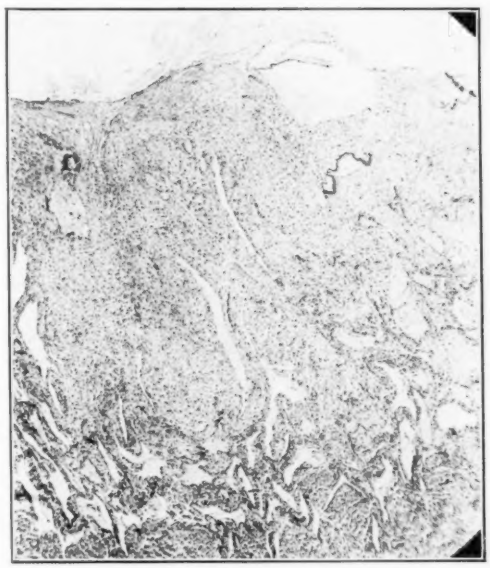

Fig. 1.—Decidua basalis from cesarean section uterus showing retention of greater part of the compact and all of the spongy layer. No dilatation of vessels (×18).

At this point, it may be inquired why sterilization was deferred instead of being effected in conjunction with a cesarean section at the time of labor. And my answer is that in a teaching clinic, I have thought it necessary so far as possible to limit the performance of cesarean section to patients presenting a clear-cut obstetric indication, as to do otherwise would foster unclear thinking, which I believe constitutes one of the major defects of American obstetrics.

Immediately after its removal, the uterus was placed in 10 per cent formalin, and was opened by a vertical or transverse section within the following twenty-four hours. In this way the preservation was ideal, and made possible the preparation of very satisfactory histologic specimens.

After these preliminary remarks, I shall pass on to the consideration of our findings.

Fig. 1 represents a low power section of the decidua basalis obtained from a cesarean section uterus removed immediately after the extrusion of the placenta. It

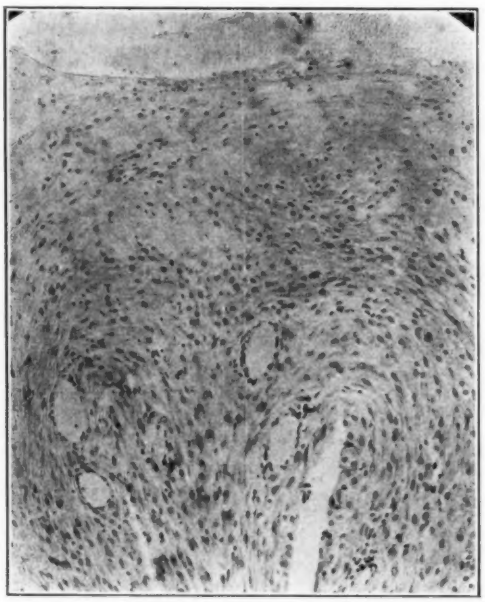

Fig. 2.—Upper part of Fig. 1, showing compact layer of decidua, and only small vessels (×75).

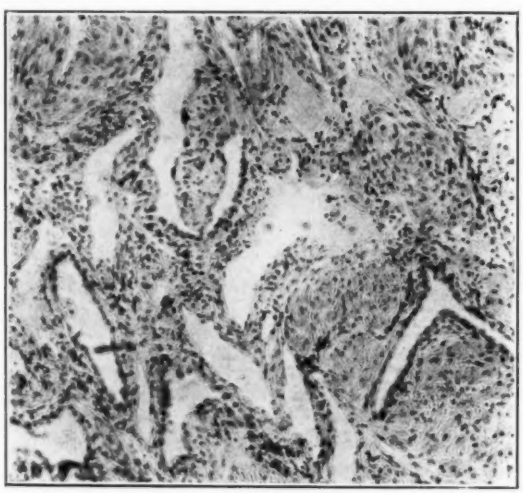

Fig. 3.—Lower part of Fig. 1, showing well preserved glands of spongy layer (×75).

will be noted that it is relatively thick, and that separation had occurred in the upper part of the compact layer, and that large numbers of compressed glands are present in the spongy layer. Furthermore, it will be noted that no distended or

thrombosed vessels are present. Figs. 2 and 3 show the same area more highly magnified and accentuate the points made. It will be noted that there is no free hemorrhage and that the vessels in Fig. 2 are small in caliber. Attention is directed to the profusion of gland spaces in the depths of the decidua and to their relation to the underlying muscle, which effectively disproves the statements of many early writers that no glands are present in the decidua basalis.

In 1917, as the result of the study of 50 uteri removed at cesarean section, I contended that the statements in the literature concerning the line of separation of the placenta and membranes were too arbitrary and schematic, and that, while separation generally occurs in the spongy layer, the line is very irregular, so that in places a thick layer of decidua is retained, in others only a few layers of cells re-

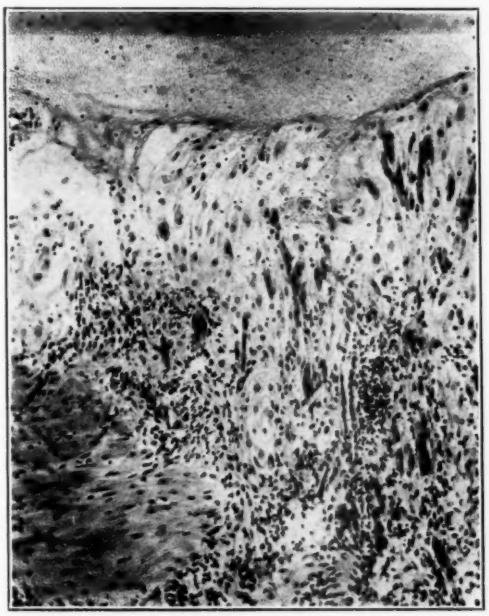

Fig. 4.—Thin portion of decidua basalis from same uterus as Fig. 1, showing chorionic giant cells(×75).

main, while in still others the muscularis is practically bare. Further experience has served to confirm such observations, and Fig. 4, which represents a section from the same placental site as shown in Fig. 1, indicates the correctness of my statements. Here are also seen the chorionic giant cells which constitute a characteristic feature of the decidua basalis and the musculature immediately beneath it.

In my experience the conditions just described constitute the usual picture of the decidua basalis at the time of labor, but in occasional instances changes in the vessels are noted, such as were described by Friedländer and Leopold, and confirmed by numerous subsequent observers. These consist in the replacement of the walls of certain arteries and veins by a thick zone of hyalin material, through which

are scattered large faintly staining cells, with the eventual replacement of the endothelium by similar cells, which may completely or partially fill the lumen. In some cases such vessels contain fluid blood, while in others it has undergone thrombosis. Reference has already been made to the prolonged discussion concerning the nature of such cells, and I am inclined to believe that they are fetal in origin, although the question cannot be regarded as finally settled.

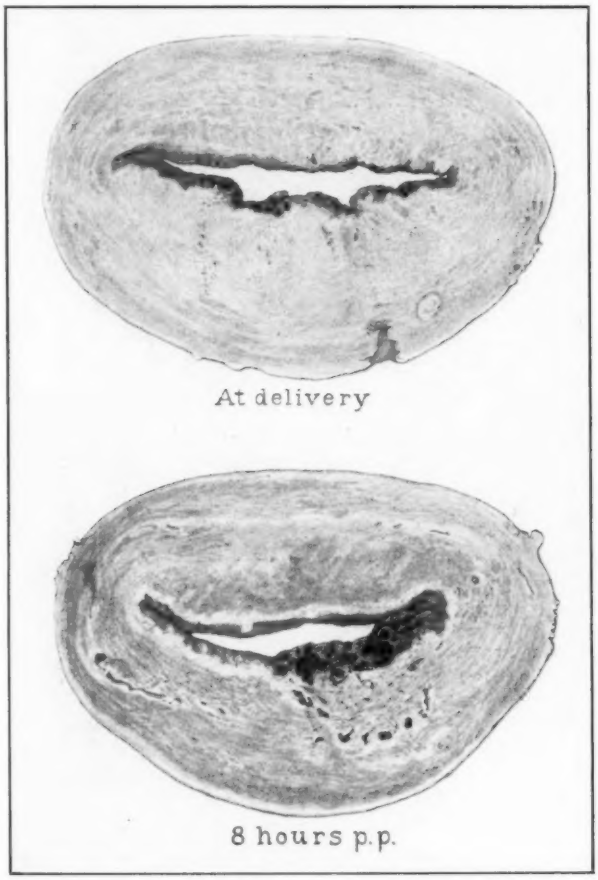

Fig. 5.—Sketch showing above cesarean section uterus without placental site, and uterus eight hours postpartum with well developed placental site (×½).

The fact that I have observed such degenerated vessels in only a fraction of the fresh placental sites which I have studied indicates that they are not essential to the further development of that location. Furthermore, the fact that their occurrence is not limited to the last weeks of pregnancy, but may sometimes be noted in the early months—when they attain unusual development—indicates that they are not necessarily connected with the terminal processes of pregnancy. Indeed, I must confess that I do not understand their significance, but I

am inclined to believe that their presence at the end of pregnancy may be regarded as more or less accidental.

Finally, in connection with the placental site immediately after the extrusion of the placenta, I may say that it is sometimes impossible to recognize its location in the hardened uterus. Frequently it is indicated by the presence of an unusual number of compressed blood vessels in a limited area of the muscularis, in other uteri it can be identified only after histologic examination, when the presence of chorionic giant cells in the basalis and the muscularis underlying it affords incontrovertible proof of its location. Fig. 5 gives a good idea of the gross appearance usually observed.

Within a few hours after the completion of labor, striking and characteristic changes occur at the placental site, and convert it from the

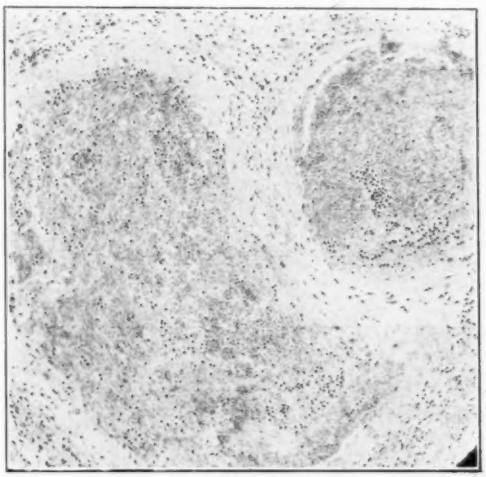

Fig. 6.—Placental site forty-five minutes postpartum, showing thrombosed veins with hyalin walls (×75).

state just described into the structure with which all pathologists and some obstetricians are familiar. When the uterus is opened the first day after labor the placental site appears as a rounded, blood stained, ragged and nodular structure, 8 to 10 cm. in diameter, and projecting 4 to 10 mm. above the general surface. On section, it is hemorrhagic in appearance and contrasts sharply with the underlying pale muscularis, while closer examination shows that it consists of large numbers of closely packed blood vessels filled with fluid and coagulated blood. This is clearly shown in Fig. 5, which represents a cross-section through the uterus of a patient dying from lobar pneumonia eight hours after delivery, and contrasts sharply with the upper figure in the same illustration, a uterus amputated after cesarean section.

This difference clearly is of great interest and the question arises as to how it is brought about. My investigations show that it begins to

develop almost immediately after delivery, as is proved by the findings in Fig. 6, from a uterus removed on account of rupture, three-quarters of an hour after delivery. This figure shows that the decidua basalis

Fig. 7.—Portion of placental site twenty-four hours postpartum (×18).

Fig. 8.—Lower part of placental site shown in Fig. 7, showing retention of endometrial tissue (×75).

is occupied by large dilated blood vessels and bears little likeness to the conditions existing immediately after delivery, as were shown in Fig. 1, and represents two large vessels with partially hyalin walls, and filled with blood in process of coagulation.

Similar, but more pronounced, conditions are present in the twenty-four-hour placental site. Examination under low power (Fig. 7) shows that the superficial portion of the basalis is almost entirely occupied by distended vessels, both arterial and venous, which are rapidly undergoing thrombosis. A more highly magnified portion of the same section (Fig. 8), shows the junction between the basalis and muscularis, and demonstrates that the deepest part of the former still retains its original structure, with definite glands and a non-decidual stroma.

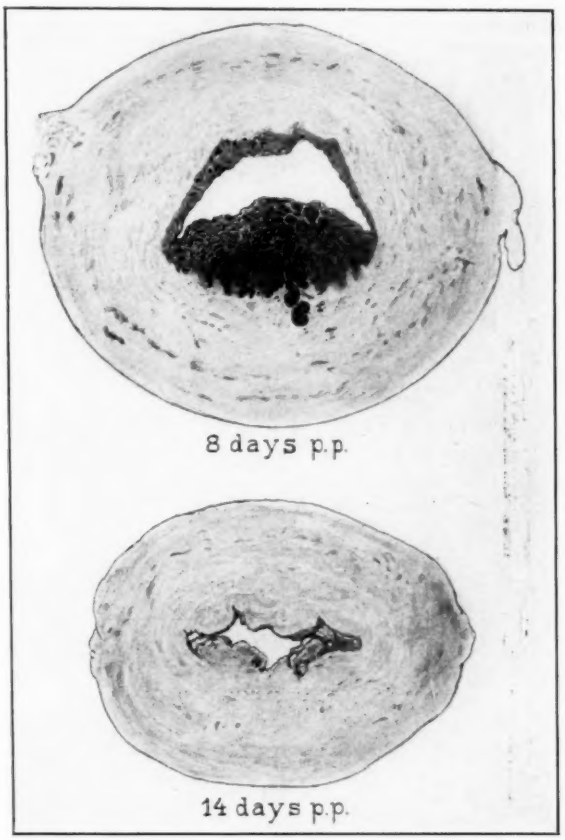

Fig. 9.—Sketch showing placental site on eighth and fourteenth days postpartum (×½).

When it is attempted to explain the genesis of this sudden change, one is compelled to theorize, but it seems probable that it is the result of variation in the intensity of the uterine contractions. It would appear that the absence of vascular engorgement immediately after delivery is due to the fact that the uterus at that time is contracted to the maximum, so that both arteries and veins are compressed to the greatest extent, thus rendering the entire organ "blood-tight." Whereas later, the contractions are less vigorous, with the result that

the thick walled arteries in the muscularis are not sufficiently compressed to interfere with circulation, while the lumina of the thin walled veins are practically obliterated, and as a consequence blood collects in the collapsed sinuses at the placental site, and later undergoes coagulation and thrombosis.

From this stage onward, the arteries undergo obliteration, while the thrombosed veins become partially or completely organized, and

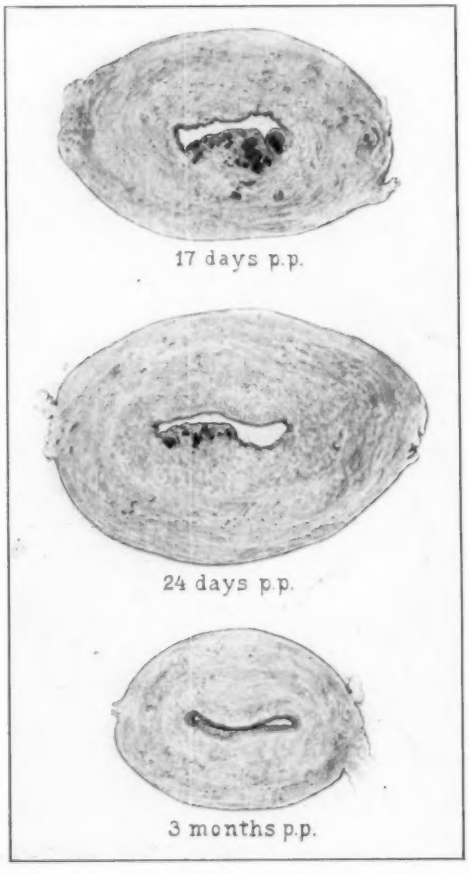

Fig. 10.—Sketch showing placental site at seventeenth, twenty-fourth, and one hundred twentieth days postpartum (×½).

projecting from the surface give the placental site its characteristic nodular structure. At the same time the placental site becomes progressively smaller, and under normal conditions disappears during the course of the seventh week. This progressive decrease in size is graphically shown in Figs. 9 and 10, which represent diagrams drawn to scale at various periods of the puerperium.

As was indicated in the historical summary, clear statements are not available as to how this is accomplished, and it is the object of this

paper to fill that gap. It was also pointed out that many writers attributed the lack of knowledge to the fact that suitable material from normal puerperal women had not been available for study, and it is hoped that the findings in the 18 specimens at our disposal will do away with that criticism.

Before taking up in detail the changes which occur at the placental site, a few words are necessary concerning the regeneration of the mucosa outside of it. As was indicated in the historical summary, most writers agree that this is usually completed during the third week and I agree with them. The rapidity with which the process is completed should not appear surprising when one recalls that even more rapid repair follows each menstrual period, as well as after an ordinary curettage, as has been known since the time of Werth.

Fig. 11 represents the extent of regeneration occurring within five days after curettage. In this instance, the suspicion of chorionepi-

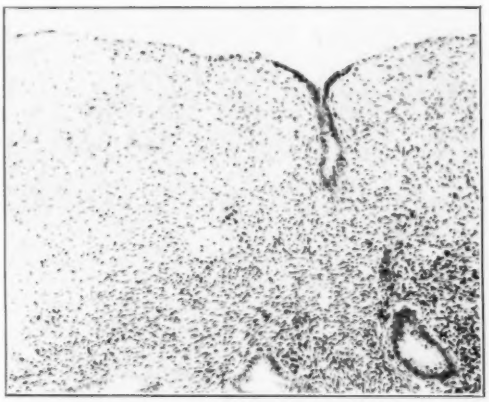

Fig. 11.—Regeneration of endometrium five days after curettage for suspected chorionepithelioma (×75).

thelioma led to a diagnostic curettage, and an erroneous diagnosis during my absence was followed by the removal of the uterus five days later. Some analogous conditions were found two days after curettage for a supposed incomplete abortion. In this instance, the existence of a tubal pregnancy had been overlooked and the uterus curetted elsewhere. Ten days later, the patient came to Baltimore, had an intraperitoneal hemorrhage while shopping, and died without operation just after admission to the hospital. Autopsy showed a freshly ruptured tubal pregnancy, and histologic examination revealed a normal endometrium without any trace of the recent decidual transformation.

Our specimens show that the endometrium is usually completely regenerated during the third week following labor, and the process appears to be effected somewhat as follows: during the first few days, the blood-stained decidua vera varies from 1 to 3 mm. in thickness, is softer than usual, and yields to the slightest touch. I possess no speci-

mens showing the histologic conditions from the third to the seventh day, but at the latter time it is found that the superficial layer is infiltrated with blood, the individual decidual cells have lost their staining properties, and have become necrotic and sometimes hyalin, while the superficial layer is more or less infiltrated by leucocytes. Beneath

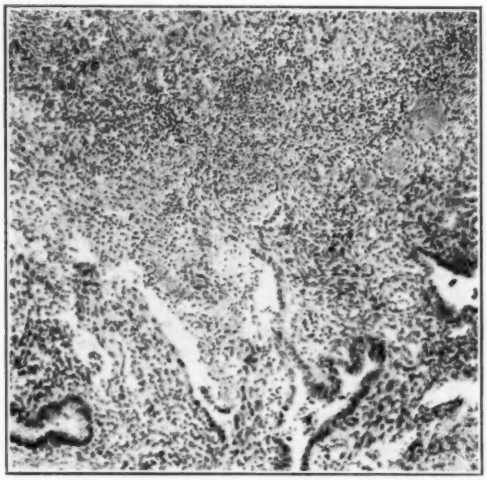

Fig. 12.—Decidua vera nine days postpartum, upper portion necrotic and lower portion with well preserved glands and stroma (×75).

Fig. 13.—Partially regenerated mucosa outside of placental site, eight days postpartum (×75).

this layer are numerous glands, which are separated from one another by a stroma, whose cells show no sign of decidual transformation. Such a condition is well shown by Fig. 12, obtained on the ninth day of the puerperium. At that time, many of the epithelial cells lining the glands are irregular in shape and size, and the nuclei have lost

their usual structure, and appear enlarged, pale and swollen. I was unable to find mitotic figures during the first two weeks. In a short time the necrotic tissue is cast off in shreds and is carried away by the lochia, and epithelium derived from the fundi of the glands grows over the denuded areas. This is well shown in Fig. 13 from an eight-day puerperal uterus.

Within a few days the entire free surface becomes covered by epithelium, when the new mucosa may be said to be restored. At first it does not always present the characteristic structure, as is shown by Figs. 14 and 15 from a twelfth-day uterus. These two pictures were obtained from adjacent portions of the same slide, and while one consists of a very thin stroma covered by a single layer of cuboidal epithelium, but without glands, the other shows fairly normal con-

Fig. 14.

Fig. 15.

Fig. 14.—Endometrium twelve days postpartum, showing regenerated epithelium but no glands (×75).

Fig. 15.—Endometrium twelve days postpartum, showing almost complete regeneration (×75).

ditions. Completely normal conditions are gradually restored, and Fig. 16, which represents the endometrium directly opposite the placental site of a twenty-one-day uterus, shows an essentially normal endometrium except for the presence of certain small areas of degeneration.

In other words, my observations lead me to conclude that from about the fourteenth day onward, the uterine cavity outside of the placental site is completely lined by epithelium, although several more days elapse before the endometrium can be regarded as fully restored.

My observations tend to indicate that neither the existence of moderate infection nor the retention of fetal tissue following abortion in full-term labor seriously interferes with regeneration outside of the

placental site; although it may definitely delay the involution of the latter. That this belief is correct is shown by the findings in a uterus removed on the seventeenth day from a patient who presented signs of intrapartum infection, but whose puerperium was afebrile. In this

Fig. 16.—Endometrium twenty-one days postpartum, showing complete regeneration (×75).

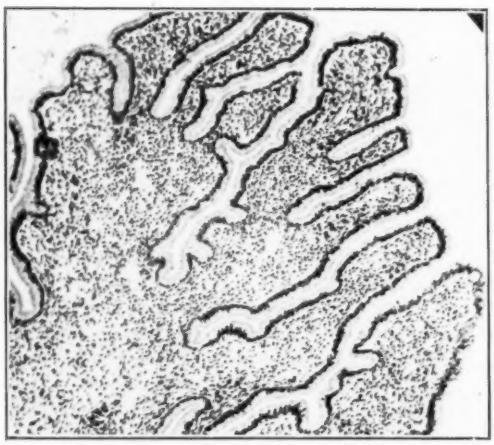

Fig. 17.—Cervical mucosa completely regenerated two weeks postpartum (×50).

instance the mucosa had been completely restored, but it was markedly infiltrated with round cells and eosinophiles, instead of presenting a stroma made up of the usual oval or fusiform cells.

In the historical section, it was stated that various authors had claimed that the cervical mucosa was not cast off during the puer-

perium, and was promptly restored to its original condition. This has likewise been my experience, and is what one would expect from Stieve's study of the behavior of the cervical mucosa during pregnancy and at the time of labor. In general it may be said that the

Fig. 18.—Placental site thirty hours postpartum (×18).

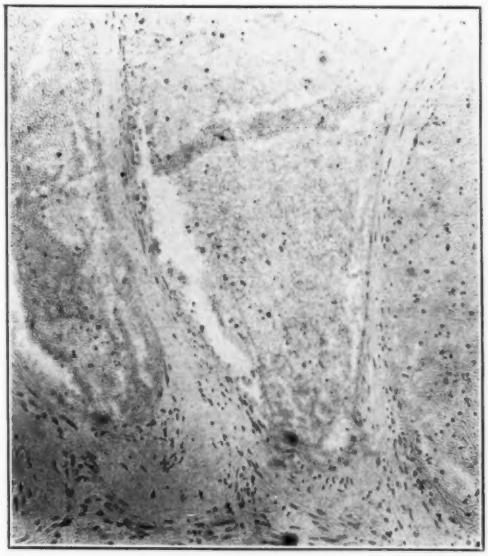

Fig. 19.—Placental site eight days postpartum, showing thrombosed vessels (×75).

cervical mucosa is not cast off, and becomes completely restored by the end of the first week, although the tissue beneath it may long remain infiltrated with blood. Fig. 17, representing a section through the cervical mucosa at the end of the second week, will serve to confirm this statement.

I shall now consider in more detail the structure of the placental site and the means by which it is obliterated.

Fig. 18, which represents a low power picture of the placental site thirty hours postpartum shows that it is in great part made up of dis-

Fig. 20.—Placental site twelfth day, showing partially organized thrombosed vein with well developed endometrium beneath it (×75).

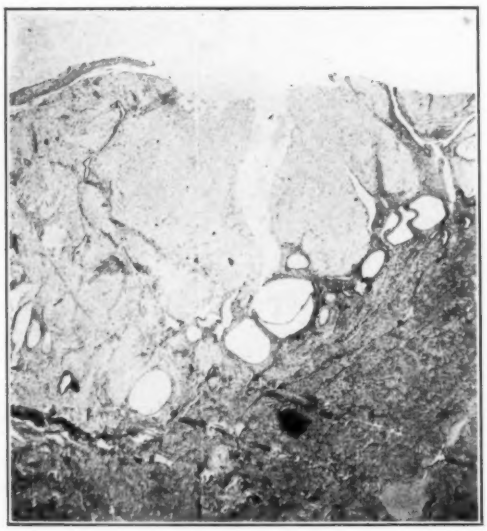

Fig. 21.—Part of placental site seventeenth day, showing undermining by endometrium (×18).

tended vessels, which are separated from one another by only a small amount of tissue. Some of the vessels represent arteries which have undergone obliteration and hyalin degeneration, but most of them are veins, whose contents have undergone coagulation, and which are beginning to become organized by the invasion of fibroblasts. At this

time there is a good deal of free blood in the superficial layers, associated with a moderate amount of leucocytic infiltration, which, however, is not pronounced unless it is associated with infection. As the puerperium advances a portion of the superficial tissue undergoes necrosis and is cast off with the lochia, but the greater part of the placental site is retained and is gradually cast off or exfoliated as will be explained later.

On the eighth day, the conditions remain essentially the same, except that the placental site has become definitely smaller, but at the same time somewhat thicker than during the first few days. Even at this time, however, not all of the thrombosed vessels have become or-

Fig. 22.—Part of placental site seventeenth day postpartum, with undermining at left margin (×18).

ganized, as is shown by Fig. 19. At this time, the placental site is not yet covered by epithelium, which appears to be limited to its margins and to its basal portion. In these locations, however, it is seen that well-developed endometrial tissue is present and apparently is extending beneath the thrombosed vessels which now make up the greater part of the placental site. This is still more clearly shown by Fig. 20, which represents sections from the twelfth day.

A few days later, the placental site is constituted by a dense mass of tissue consisting of obliterated arteries and thrombosed and organized veins, while a good deal of the tissue between them has undergone hyalin degeneration. Figs. 21 and 22 show the conditions in two specimens at the seventeenth day. In the first, the placental site ex-

tends deeply down into the muscle wall, while in the other it projects into the uterine cavity and presents margins which are being undermined by endometrium extending from the free portion of the uterus.

In Fig. 21, it is seen that endometrium tissue lies between the placental site and the muscularis and that its glandular spaces are dilated into irregularly shaped cavities. By this time a certain amount of mucosa has advanced over the free surface of the placental site, partially covering it and sending processes down into the interior.

Fig. 23 gives a good idea of one margin of the placental site under higher magnification and shows obliterated vessels separated by endometrial stroma, while at the lower left-hand corner typical endometrial glands and stroma are seen. The hyalin structure at the base of the section is clearly an obliterated artery, which presumably repre-

Fig. 23.

Fig. 24.

Fig. 23.—Placental site seventeenth day, showing thrombosed vessels and undermining by endometrium (×75).

Fig. 24.—More highly magnified portion of Fig. 22, showing regenerated endometrium on free surface with thrombosed vessels beneath (×75).

sents the peripheral end of a similarly obliterated vessel lying in the muscularis beneath the placental site.

Higher power preparations from the other seventeen-day uterus give still further information concerning the endometrial growth. Fig. 24 shows that the free surface of the placental site is covered by a thin layer of well regenerated mucosa, while beneath it are a number of organized vessels. On the other hand, Fig. 25 shows that endometrial tissue has developed between the placental site above and the muscularis below; in other words, it is showing signs of undermining the latter.

A few days later, the placental site has become definitely smaller, and Fig. 26 gives a wonderful picture of the conditions prevailing at

the twentieth day. Here the placental site is seen as a broad rounded projection into the uterine cavity, and comes almost in contact with the regenerated mucosa on the opposite wall of the uterus, and is clearly seen to be made up of organized vessels. On the right-hand

Fig. 25.—Another area from Fig. 22, showing endometrial tissue beneath placental site (×75).

Fig. 26.

Fig. 27.

Fig. 26.—Twentieth day placental site completely filling uterine cavity and coming in contact with regenerated mucosa of opposite wall (×18).

Fig. 27.—Area from Fig. 26, showing endometrium beneath placental site (×75).

side the lumina of numerous glands are present, while in the lower left-hand corner it is apparent that the margin of the placental site is being undermined by endometrial ingrowth.

These conditions are rendered even clearer by the study of several more highly magnified sections. Thus, Fig. 27 from the margin of the same placental site shows the presence of well developed endometrial tissue between it and the underlying muscularis, and Fig. 28 shows the invasion of the characteristic placental site tissue by narrow strands

Fig. 28.—Another area from Fig. 26, showing invasion of hyalin tissue by endometrial processes (×75).

Fig. 29.—Twenty-fourth day placental site with endometrial undermining on right side (×18).

of endometrium. Similar conditions were noted in a specimen from the twenty-first day, but space does not permit their presentation.

As the puerperium advances the placental site is constantly growing smaller, and Fig. 29 represents under low power the conditions at the base of the placental site on the twenty-fourth day. Here again one

sees the placental site with its characteristically obliterated vessels, and at its base, and particularly in the right lower corner, the undermining endometrium. Fig. 30 gives a more highly magnified picture of the latter area; and shows well developed endometrium beneath an organized thrombosed vessel.

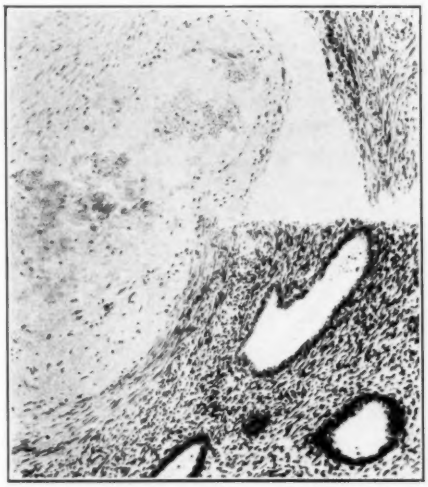

Fig. 30.

Fig. 31.

Fig. 30.—A portion of Fig. 29 (×75).
Fig. 31.—Hyalin vessel lying free in uterine cavity eight days postpartum (×50).

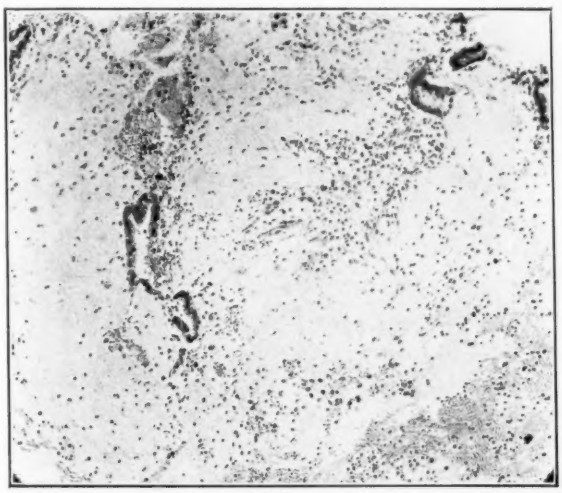

Fig. 32.—Fragment of placental site with endometrial inclusions free in uterine cavity (×50).

From this time onwards, the placental site rapidly becomes smaller and smaller, to disappear eventually at about the end of the seventh week, and the question arises as to how the decrease in size and eventual disappearance is brought about. It seems to me that the evidence thus far adduced makes three points clear: first, that the process is in no way connected with inflammatory change; second, that

there is no indication of any extensive necrotic process; and third, that all of the specimens show unusual proliferation of endometrial tissue, which does not merely cover the surface of the placental site, but invades it in all directions, but particularly extends between it and the underlying muscularis, so that in a general way it undermines the placental site and ultimately leads to its extrusion or exfoliation.

Fig. 33.

Fig. 34.

Fig. 33.—Fragment of endometrial tissue lying free in uterine cavity twenty-six days postpartum (×50).

Fig. 34.—Exfoliation of polypoid masses of tissue, twenty-first day postpartum (×75).

Fig. 35.—Pedunculated mass of placental site tissue in process of extrusion, twenty-fourth day postpartum (×75).

I think it fair to state that the preparations thus far considered make such a supposition appear plausible, but that the evidence is not conclusive. Consequently, additional evidence must be adduced if one expects to prove that the placental site is exfoliated as the result of undermining by endometrial tissue.

To my mind, this is easily done, as even casual examination of the sections conclusively shows that tissue of various kinds can be found free in the uterine cavity throughout the puerperium, and that these may consist of shreds of necrotic mucosa; of particles of tissue which can readily be identified as obliterated and hyalin vessels; of particles of hyalin tissue containing fragments of endometrium; of fragments of completely regenerated endometrium; and finally of polypoid masses of tissue which can be demonstrated upon the surface of the placental site in actual process of extrusion. Furthermore, this casting off of tissue is not limited to the two weeks during which the lochia persist, but it continues up to the very moment the placental site disappears.

For example, Fig. 31 shows an obliterated vessel found free in the uterine cavity on the eighth day. Furthermore, Fig. 32 shows tissue

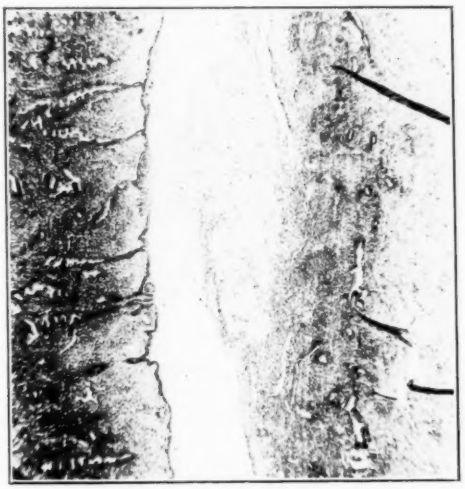

Fig. 36.

Fig. 37.

Fig. 36.—Remnant of placental site, forty-eighth day postpartum (×18).
Fig. 37.—Part of Fig. 36 (×75).

found free in the uterine cavity on the twenty-first day; while Fig. 33 shows a fragment of endometrial tissue found on the twenty-sixth day.

Still more conclusive evidence is afforded by Figs. 34 and 35 in which polypoid masses made up of hyalin and partially organized placental site tissue are attached to the surface of the endometrium by such narrow peduncles that but little imagination is required to visualize their separation.

Finally, the crowning evidence is presented by a uterus forty-eight days after delivery, in which the placental site is represented by a tag of tissue, 1 × 3.5 mm., projecting into the uterine cavity, but still attached by its base to the superficial portion of the endometrium. This is strikingly illustrated by Figs. 36 and 37, the latter representing a high power picture of the former, and which clearly shows that the stroma of the polypoid mass presents the histologic structure which

we have learned to consider characteristic of the placental site. To my mind, these pictures are so convincing that more detailed description seems unnecessary. Furthermore, in order to show that the process of regeneration has been completed, I would direct attention to the tortuous and corkscrew-like character of the glands in the regenerated endometrium of this specimen. It is clear that they belong to an advanced period of premenstrual swelling, and that this is the case is proved by the fact that the patient began to bleed on the morning of operation, as well as by the additional fact that other portions of the same endometrium showed the characteristic changes associated with actual menstruation.

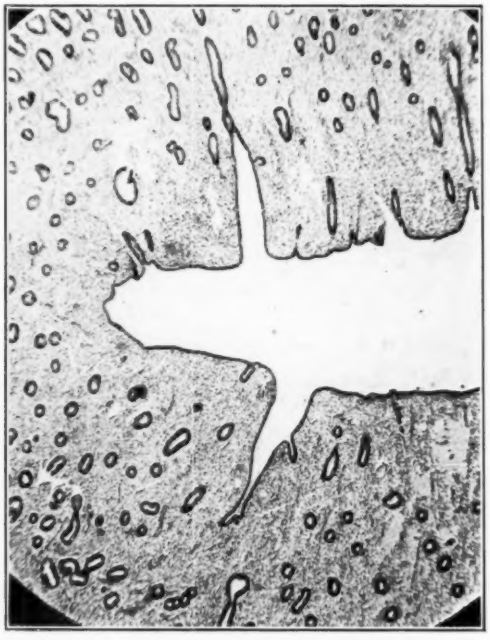

Fig. 38.—Completely regenerated mucosa fifty-first day postpartum. All trace of placental site has disappeared (×50).

Finally, I would direct attention to Fig. 38, which represents a section through a fifty-one-day uterus, and shows the return to absolutely normal conditions.

In the foregoing pages, I have attempted as briefly as is consistent with clarity to outline the fate of the placental site in the normal puerperal woman, and I feel that it has been made clear that six to seven weeks are required for its disappearance, and that it is not effected by absorption in situ, but rather by a process of exfoliation which is in great part brought about by the undermining of the placental site by the growth of endometrial tissue. This is effected in part by extension and downgrowth of endometrium from the margins of the placental site, and partly by the development of endometrial tissue from the glands and stroma left in the depths of the decidua basalis after separation of the placenta.

In general, I am inclined to attach more importance to the former than to the latter mechanism, for the reason that in many instances, the base of the placental site extends beyond the limits of the original basalis so that obliterated arteries and thrombosed veins may lie in the inner layer of the muscularis, and consequently must be extruded before an entirely normal endometrium can be degenerated. In this event, the endometrial tissue derived from fragments of the basalis would lie internal to such vessels, so that it would seem that the only method by which endometrium could come to lie external to them would be by some such process of invasion and undermining, as I have described.

Regarded from another point of view, such a process of exfoliation should be regarded as very conservative, and as a wise provision on the part of Nature; otherwise great difficulty might be experienced in getting rid of the obliterated arteries and organized thrombi, which if they remained in situ would soon convert a considerable part of the mucosa into a mass of scar tissue, with the result that after a few pregnancies it would no longer be possible for it to go through its usual cycle of changes, and the reproductive career would come to an untimely end. Moreover, in a certain way, this mechanism of exfoliation is suggestive of the life history of the corpus luteum, which, leaving out of consideration its internal secretory function, appears to have as one of its objects the prevention of the undue formation of scar tissue in the ovary.

Before bringing this somewhat lengthy paper to a close, I wish to refer to several points of interest in connection with the process. In the first place, if exfoliation is effected as I have indicated, the question arises as to why it is not entirely limited to the undermining and extrusion of the placental site, instead of the endometrial tissue covering, in part at least, the free surface of the placental site or invading its depths, as our specimens show, with the result that large amounts of newly formed endometrial tissue are cast off during the exfoliative process. For this I can give no satisfactory explanation, and I can only suggest that in this, as in many other separative processes Nature appears to be unduly lavish.

Again, I would direct especial attention to the fact that throughout the entire process fragments of tissue are being cast off. For many years, we have associated loss of tissue with the lochial flow, but I imagine that few of us had any idea that the process continues for a month or more after its cessation—in other words, that it lasts throughout the entire anatomic puerperium.

Furthermore, in examining my specimens, I was rather impressed with the relative absence of phagocytes containing blood pigment. It is a well-known physiologic fact that they are unusually abundant in tissue which is caring for past hemorrhage, but in general they were less frequent in the placental site than one would expect. In several

specimens they were present in large numbers, while in others they appeared to be scanty or even entirely lacking.

In discussing the fresh placental site, I referred to the presence of characteristic chorionic giant cells in the decidua basalis and in the muscularis underlying it, and I stated that in many cesarean section uteri their recognition afforded the only means of identifying that area. Likewise, in the historical section, I mentioned the views of various writers concerning them. In this place, I merely wish to state that in my experience they usually disappear by the eighth or tenth day, and that their persistence later is exceptional. Indeed, whenever that occurs, I am inclined to believe that chorionic villi have been retained in utero. At least, that was the case in two specimens examined after abortion, but my experience in that regard is too slight to be of value at the moment, and it must remain a subject for future investigation.

Likewise, I have repeatedly referred to the presence of obliterated arteries at the placental site, with unusual proliferation of the intima and pronounced hyalin changes in the rest of their walls, and in the historical section I referred to the discussion as to their nature, which has already lasted over a half century without being definitely settled. In this place I hesitate to mention the subject, and only do so for the purpose of stating that I regard the obliterated arteries at the placental site as the peripheral terminations of vessels presenting similar changes in the muscle wall of the uterus. These lateral ends are cast off with the placental site, while the distal portions remain in situ and present the characteristic picture which some designate as sclerosis, and with which we are all familiar. Certain of these vessels are doubtless replaced by smaller ones as described by Goodall, others become entirely obliterated and are probably completely absorbed, while in many women large numbers persist for the rest of life, and afford a means for diagnosticating the existence of previous pregnancy. In my opinion, the complete disappearance of the distal ends at the placental site, and the persistence of the rest of the vessel elsewhere, would seem to constitute an additional argument in support of my view of exfoliation.

Finally, I would refer once more to the quotation from Ries, in the historical section, and desire to redirect attention to the fact that he is the only writer with whom I am familiar, who has described anything like the process of exfoliation here set forth. At the same time, his description is too meager and his specimens too faulty, to justify any positive opinion. If, however, he and I noted the same process it would appear strange that it has been overlooked during the forty odd years which have elapsed between the two papers.

NOTE: The bibliography of this article was not completed owing to the death of Dr. Williams.

(For discussion, see page 793.)

THE PATHOLOGY OF SOME SPECIAL OVARIAN TUMORS AND THEIR RELATION TO SEX CHARACTERISTICS*

By Professor Dr. Robert Meyer, Berlin, Germany

IT MAY appear unusual to state that tumors may possess function. Admittedly however every body cell functions even if abnormal; and cells of a newgrowth may exhibit a specific functional capacity exactly corresponding to the function of the tissue from which they arise. We know that the ovary plays a special rôle in the determination of sex characteristics both in the body as a whole and in the genital organs, therefore, it cannot be surprising to find that in some ovarian neoplasms the tumor cells functionate and participate in this process of development of secondary sex characters.

Fig. 1.—Testicular seminoma, cells secondarily invading testicular tubules.

I. Disgerminoma ovarii (so called "seminoma")

I have given the name "Disgerminoma" to the first type of tumor to be discussed here. French writers call it "Seminoma ovarii" because of its histologic similarity to the so-called seminoma of the testis, which represents about 60 per cent of all testicular neoplasms. It is carcinomatoid in character since it consists of large epithelial cells. The term seminoma was chosen because this testicular newgrowth in parts of it structure resembles seminal tubules. As a matter of fact these tubular formations are not produced by the growth;

*Read by invitation at the Fifty-sixth Annual Meeting of the American Gynecological Society, Hot Springs, Va., May 18 to 20, 1931.

they only represent seminal tubules secondarily invaded by the neoplasm, as seen in Fig. 1. The structure of the testicular tumor is alveolar for the greater part and only in this respect does it resemble an ovarian tumor. Of course, the latter contains no tubules, but otherwise these neoplasms of testis and ovary are very similar histologically, differing only in the relative quantity of connective tissue and the cord-like arrangement of epithelial masses (Figs. 2 and 3). These tumors are furthermore characterized by a lymphatic infiltration of the connective tissue and by loosely joined epithelial cells which are rich in protoplasm.

A long time ago I had observed that these neoplasms are seen very often in pseudohermaphroditic individuals. I have collected 27 cases

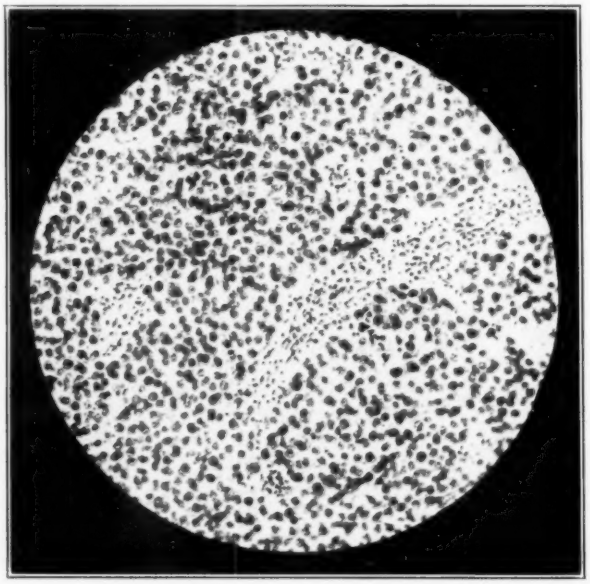

Fig. 2.—Disgerminoma testiculi.

of this type: 4 had a definite testicle on one side, 8 had a doubtful testicle on the other side; of 6 other cases, 5 probably had an ovary and 1 a definite ovary on one side. In 5 instances the tumors were bilateral and the patients showed predominantly female characteristics but it was impossible to determine definitely the nature of their sex glands. In 2 cases the other sex gland was aplastic or rudimentary. In 2 individuals there was an ovariotestis on the other side. In a number of these patients certain physical and mental characteristics did not accord with the type of sex gland they possessed.

But I have also collected 21 cases in women with typically female body, without hermaphroditism. Of these, 5 had bilateral tumors; in 2 instances the condition of the opposite ovary was unknown, while

in 11 it was normal, and in 3 cases the other ovary was completely absent.

In the presence of these tumors we find, in women, external genitalia and uterus infantile in character, and, in men, cryptorchism with poorly developed testicles.

One of the striking features of this type of ovarian newgrowths is the early age at which they appear, usually in the second or third decade: 11 patients were between nine and eighteen years old, 5 between twenty and twenty-eight years, and 3 patients between thirty-three and forty-nine years old.

This variety of neoplasm in the testes of normal men or male hermaphrodites occurs at a much later age.

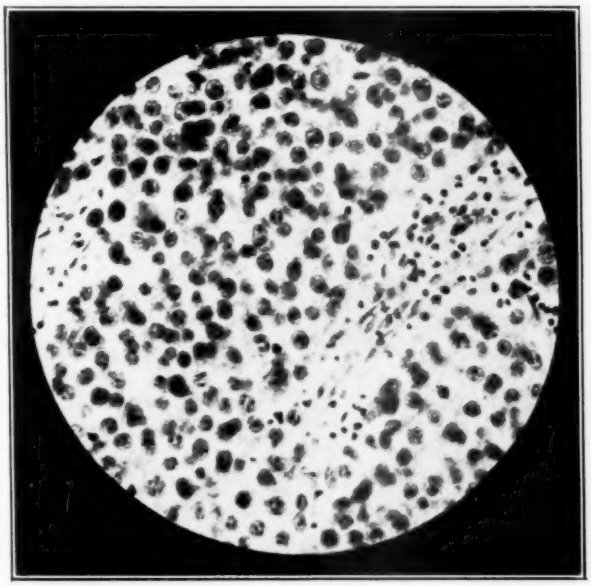

Fig. 3.—Disgerminoma ovarii. Similarity to Fig. 2 is evident.

Such tumors in the sex glands of either sex show in general the same form of histologic structure, excepting the secondary invasion of the seminal tubules in the male. They occur especially in poorly developed sex glands of normal persons, in pseudohermaphrodites, and in ovariotestis. We, therefore, must conclude that they arise from cells which existed in the embryo before the stage of sex differentiation. It is my belief that they arise from an undifferentiated form of germinal cells which had lost their faculty of becoming either masculine or feminine in type. In other words, these early germinal cells have lost their specific power of sex direction and therefore can develop into identical pathologic structures in both types of sex glands.

As these tumors originate from undifferentiated sex cells they necessarily will be void of any specific hormonal influence and thus fail to exert a specific stimulation for development of the secondary sex characters. They neither masculinize nor feminize the individual.

Disgerminomas may attain an enormous size and thereby destroy the ovary and even uterus, but if operated upon the prognosis is good. Many cases remain permanently cured without recurrence.

II. GRANULOSA CELL TUMORS

In this class of ovarian tumor the structure assumes a variety of forms. It may occur: (1) as a folliculoma, often associated with cysts (Fig. 8); (2) as solid masses (Fig. 9), or in thin cords (Fig. 10), or

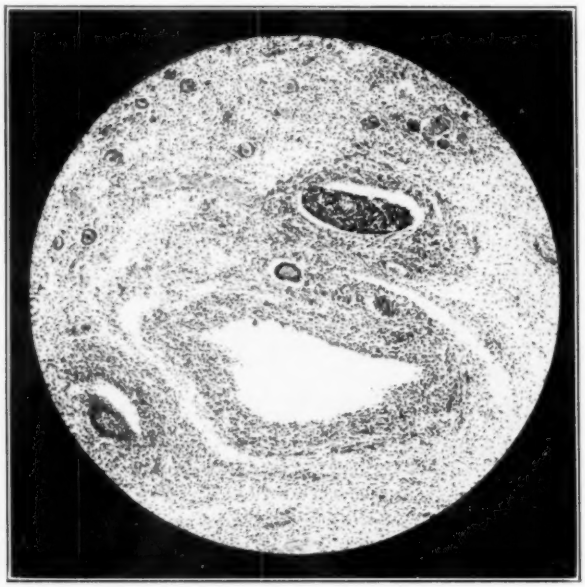

Fig. 4.—Solid masses of granulosa cells in medullary portion of ovary of newborn infant.

sometimes as tubules but most common are the solid, carcinoma-like masses often containing areas of hyaline degeneration of the stroma (Fig. 11); and (3) finally as a diffuse structure resembling a sarcoma (Fig. 12).

All these various forms may be found represented in one and the same growth though one may predominate, or even each may occur independent of the other. Thus they can merge from one form into another and we must conclude that they all arise from only *one* type of cell.

The morphologic resemblance to the normal granulosa cell is most striking in the folliculoid form. One may discover even a sort of theca cell around cysts and cell masses. In most instances the charac-

teristics of granulosa cells can be recognized only through transitional forms.

In my opinion these tumors arise from undifferentiated cells and not from epithelial cells of the true follicle.

It has never been demonstrated that such a growth could originate from the follicle, and it is more than unlikely that the granulosa cells of a true follicle could produce such a growth, because the life of granulosa cells is depending upon the fully functioning ovum. Even though granulosa and theca cells proliferate in the case of chorionepithelioma or hydatiform mole, they always disappear after removal of the chorionepithelioma or mole, and thus could not any longer become responsible for the formation of a granulosa cell tumor. Structures which in these tumors resemble follicles, can never be considered

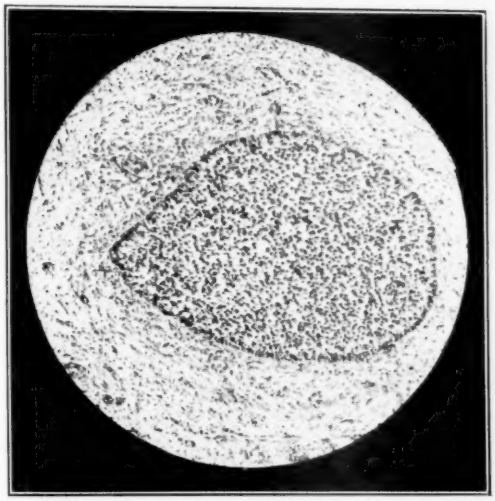

Fig. 5.—Solid masses of granulosa cells in the ovary of a woman forty-five years old.

the source of the neoplasm because they are only the products of the abnormal growth of these specific cells, as will be explained presently.

These granulosa cell tumors occur most frequently in women from sixty to seventy-four years of age, in whom the ovary no longer contains follicles. Therefore, in the majority of instances it is impossible to even think of their origin from follicle cells. We are forced to look for some other source, because granulosa cells which do not participate in the normal development and normal function of the ovarian tissue, will remain uninfluenced by the menopause.

We might assume that such unused granulosa cells would be situated chiefly in the medullary portion of the ovary because there we find masses of such cells in the ovary of every full-term fetus and also of most newborn girls (Fig. 4). It is of still greater significance that such solid masses of granulosa cells are also found in the ovaries of adults, as, e.g., in one woman, forty-five years of age (Fig. 5).

Such unused cells may remain in that undifferentiated state which is characteristic for the embryonic ovary where it is impossible to

Fig. 6.—Small granulosa cell tumors in the otherwise normal ovary of a woman forty years old.

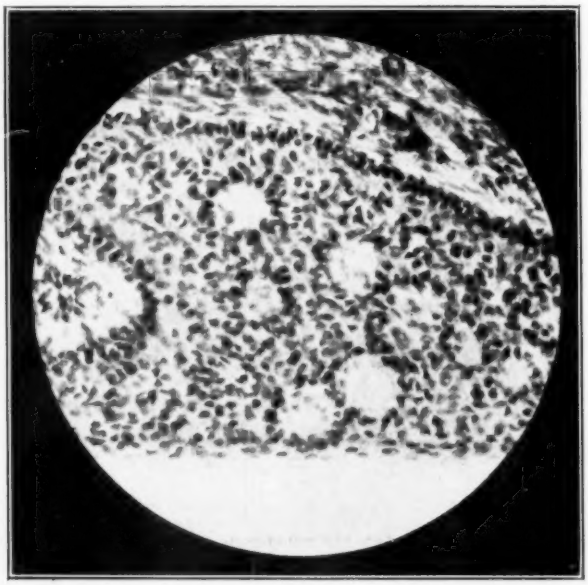

Fig. 7.—Same as Fig. 6. Higher magnification showing follicle-like structures.

make out any differences between individual cells. They seemingly can persist without further differentiation late into life, and thus we are led to the assumption that, under certain, still unknown condi-

tions, they might at any stage in children or in elderly women be able to produce granulosa cell tumors. Figs. 6 and 7 show in the medullary portion of an otherwise normal woman of forty years, proliferations of

Fig. 8.—Folliculoma associated with cysts.

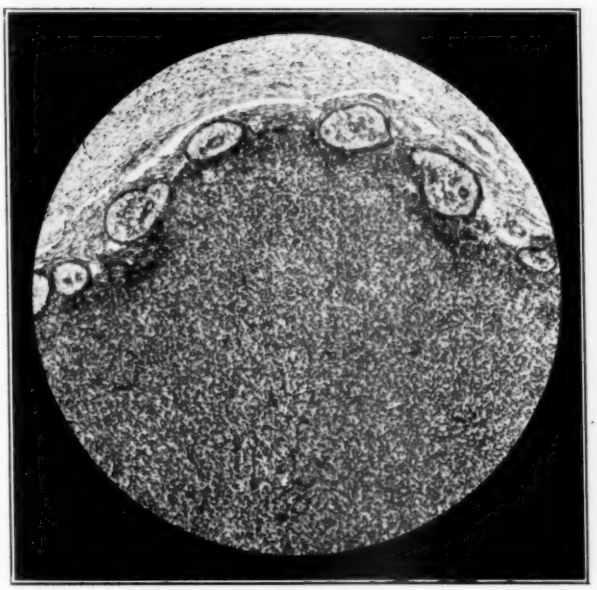

Fig. 9.—Solid masses of granulosa cell tumor.

granulosa cells which might well be looked upon as small tumors. The small cysts one can see in this specimen are neither follicles nor structures derived from follicular tissues because there is no ovum and no

theca interna. The epithelium is arranged quite irregularly and begins to penetrate into the connective tissue. This gives the same histologic appearance as seen in older tumors which contain hundreds and even thousands of such cysts.

Finally I wish to call attention to two cases reported by me some time ago in which the granulosa cell tumors arose from tissue attached to the ovary, proving some embryonic anomaly associated with this neoplasm.

Granulosa cell tumors are not by any means uncommon. Thirty-three cases collected by me include 3 children, 5 women at ages between twenty and thirty-nine years, 8 between forty and forty-nine years, and 7 women over fifty years old, among the latter there were

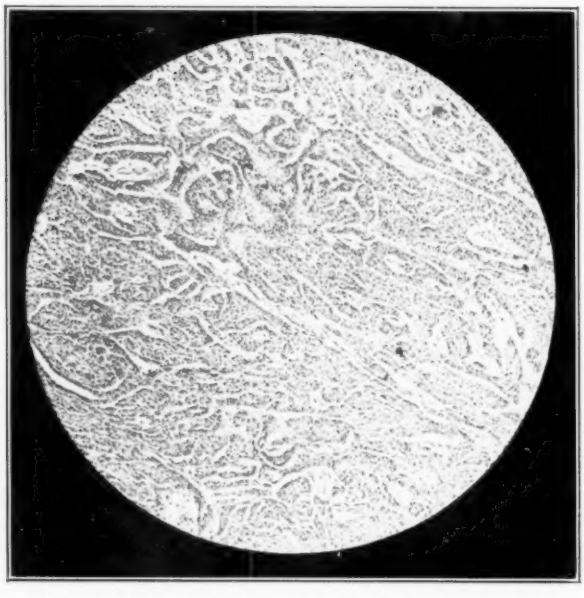

Fig. 10.—Interlacing cords in granulosa cell tumor.

5 over seventy years. Of these 33 cases, one woman died soon after operation and only 3 from later metastases. As far as I could ascertain 19 remained permanently cured after operation, most of them for more than one year, others for more than four years. Of the operated children, 2 were cured for more than ten years; one of them was operated upon at the age of five years and reoperated upon three years later for a recurrence, but then remained well.

In 27 of my cases bleeding was an important symptom. In all of those studied by me microscopically the endometrium was found to be hyperplastic and the uterus enlarged. After removal of the tumor abnormal bleeding stopped and in younger individuals, if not all the ovarian tissue was removed, menstruation again became normal.

So we must conclude that the hypertrophy of the uterus was caused by the ovarian neoplasm. Certainly hypertrophy of uterus and hyper-

plasia of endometrium seen in patients past the menopause must have been induced by the ovarian tumor. The endometrial hyperplasia in such women is due to the proliferation of granulosa cells, this prolif-

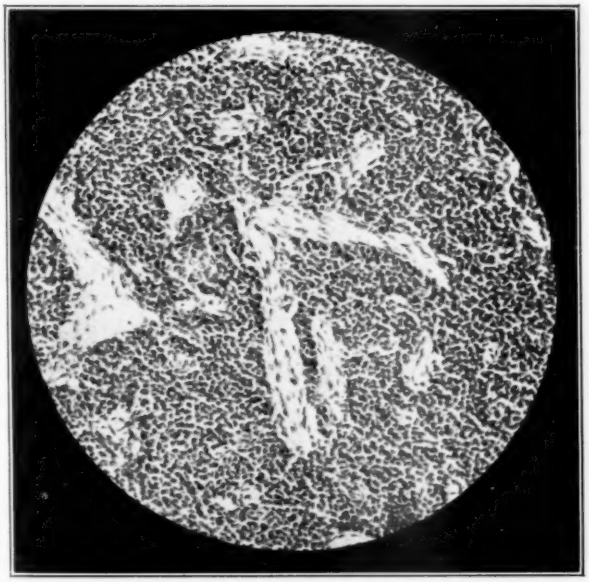

Fig. 11.—Solid, carcinoma-like granulosa cell tumor with hyaline degeneration.

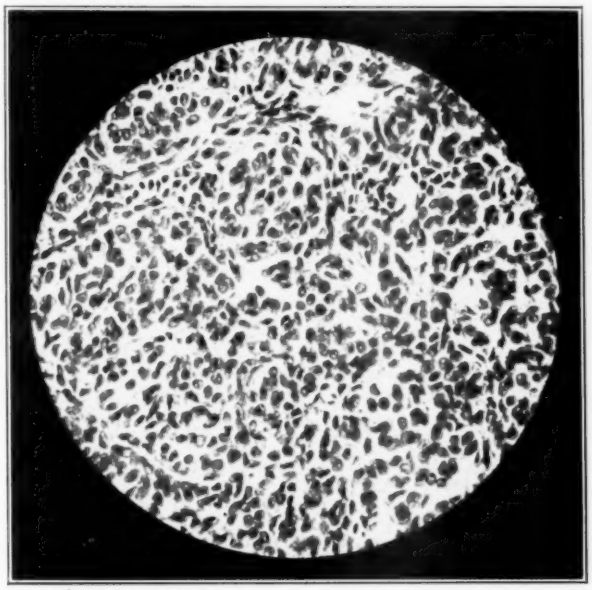

Fig. 12.—Diffuse granulosa cell tumor resembling a sarcoma.

eration resulting in augmented hormonal effect. Undoubtedly as the result of this latter effect we found in 2 cases hypertrophic breast glands, and saw a galactorrhea in 2 old women, sixty-one and seventy

years of age respectively. In one reported case there was discovered a well developed decidua in a hypertrophic uterus of a woman sixty-three years old.

In my own cases, 2 children, five and eleven years old, showed precocious development, uterine bleeding, hypertrophic breasts, one of the two even colostrum secretion. Thus we have both histologic and hormonal proof that these tumors arise from granulosa cells, and lead not only to precocity in the young but likewise to a sort of rejuvenation in older individuals.

III. ARRHENOBLASTOMA OF THE OVARY

The third class of tumors to be discussed in this paper is of particular interest in so far as they tend to cause women previously exhibit-

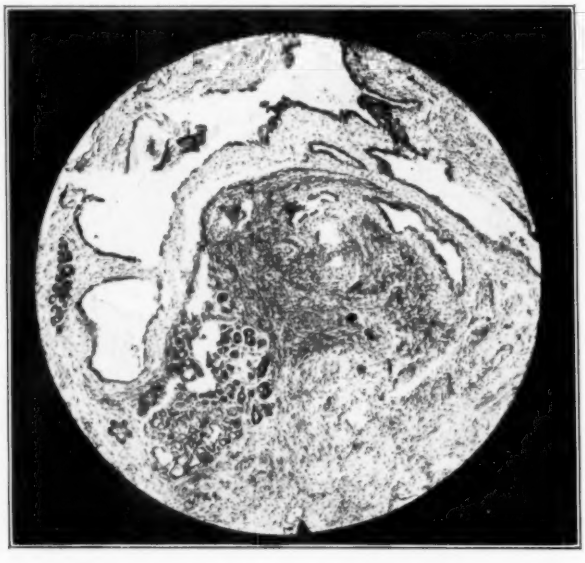

Fig. 13.—Tubular adenoma in the hilum of an adult ovary, attached to the rete ovarii.

ing normal female characteristics to take on those typical for the male sex. In these patients we notice such signs of defeminization as falling out of the hair of the head and deposits of fat. There is a coincident atrophy of the breasts, shrinkage of the opposite ovary when not affected, and atrophy of the uterus with consequent amenorrhea and sterility. At the same time positive signs of masculinization manifest themselves, such as male hirsuties, growth of a beard, enlargement of clitoris, hypertrophy of larynx with male voice and other male characteristics. These evidences of masculinization greatly diminish or disappear completely after extirpation of the ovarian neoplasm. The woman who is operated upon returns more or less fully to her former femininity. Menstruation reappears, even pregnancy may occur, as was the case in two of my own patients. On the other hand, the signs of masculinity return with a recurrence of the growth.

Thus we are justified in the conclusion that these particular tumors produce typical sex hormones, identical with those which stimulate the development of normal males, and that a deficiency in this stimulus

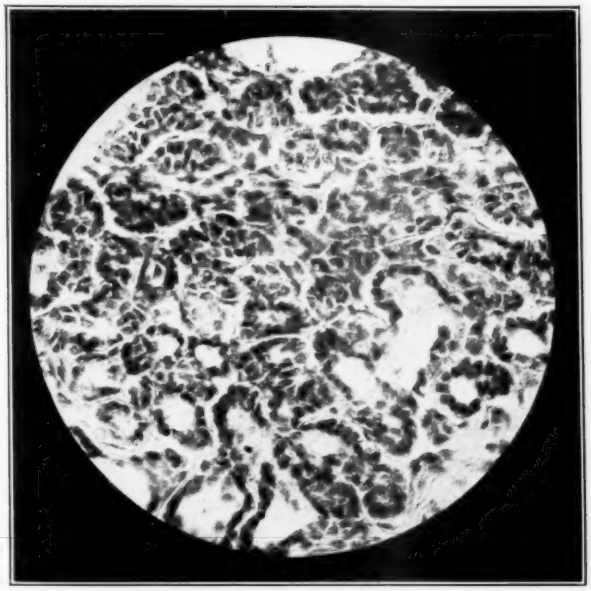

Fig. 14.—Same as Fig. 13. Higher magnification.

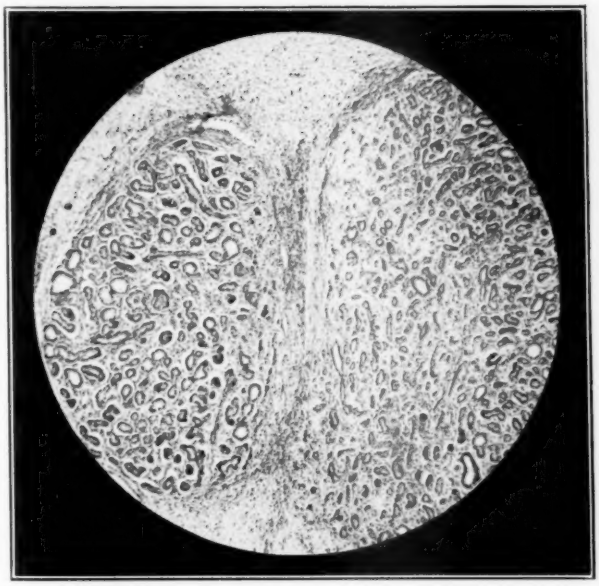

Fig. 15.—Adenoma tubulare testiculare (Pick).

results in hermaphroditism. The fact that they can produce male characteristics, in my opinion, does not of itself furnish sufficient ground to call them arrhenoblastomas (*arrhenos* meaning male).

There are different forms of this neoplasm. At least one of them, very characteristic in type, the so-called *adenoma tubulare testiculare* certainly does not induce somatic changes toward the male in all pa-

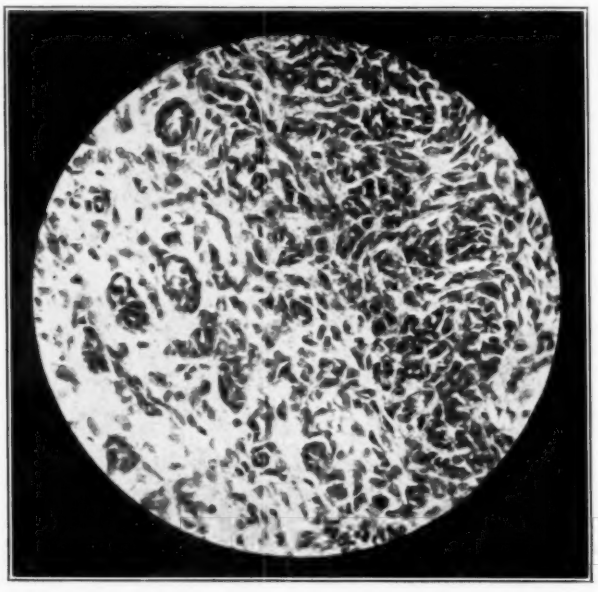

Fig. 16.—Adenoma tubulare testiculare associated with marked masculinization.

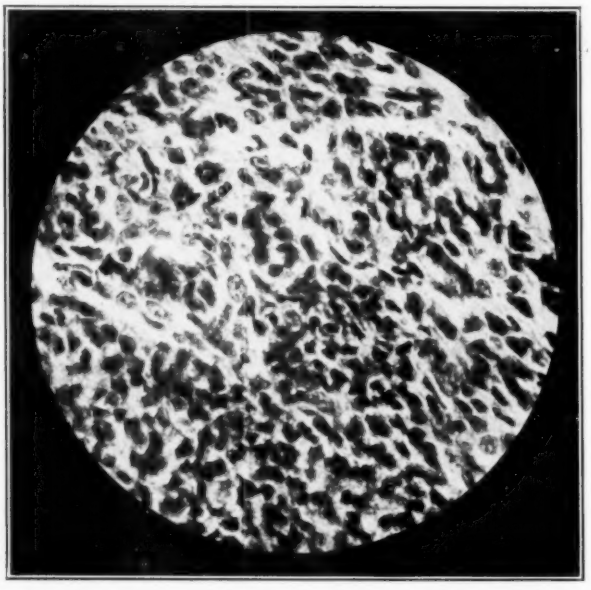

Fig. 17.—Adenoma tubulare testiculare associated with marked masculinization.

tients. Another reason for calling these tumors arrhenoblastoma of the ovary is based on the theory that, whether or not they produce male characteristics, they always arise from definitely male-directed

cells. I believe that they originate from undifferentiated germ cells which are not utilized during embryonic development and nevertheless retain their sexual potency. Under certain external conditions they begin later in life to proliferate and then only begin to exert an influence in the direction toward maleness.

A site particularly predisposed to initiate this change of sexuality I believe to be the hilum of the ovary. In every embryonic sex gland undergoing development into an ovary, cells of the hilum remain for some time in an undeveloped state (blastema). This blastema under normal conditions later on produces the rete ovarii and some medullary cords or tubules which are homologues of the rete testis and the tubuli efferentes of the testicle in the male.

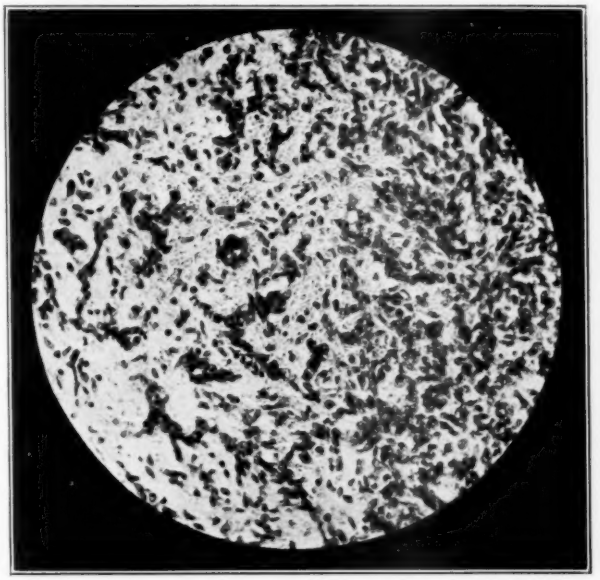

Fig. 18.—Adenoma tubulare testiculare associated with marked masculinization.

The future sexual character of the young embryo is not unalterably determined from the beginning, at least not in all instances, but does depend upon determining factors in the *genes* of the chromosomes. A priori every embryo and also every embryonic sex gland has the potential faculty of developing into either the male or female direction.

The rete ovarii and the medullary tubules, which do not exert any functional influence on the female sex gland, prove the normal bisexual *anlage* of the gonads. If these structures then persist in part in an undifferentiated state, and later for unknown reasons begin to proliferate, they may induce a male direction of development and thus change the sexual characteristics by creating bisexual stimulation like an ovariotestis.

In the hilum of an adult ovary, I found a small tubular adenoma in

a very young stage attached to the rete, which proves this type of neoplasm may have its origin just in this location (Figs. ~~12~~ 13 and 14). Therefore it is not the hormonal effect alone which justifies the name

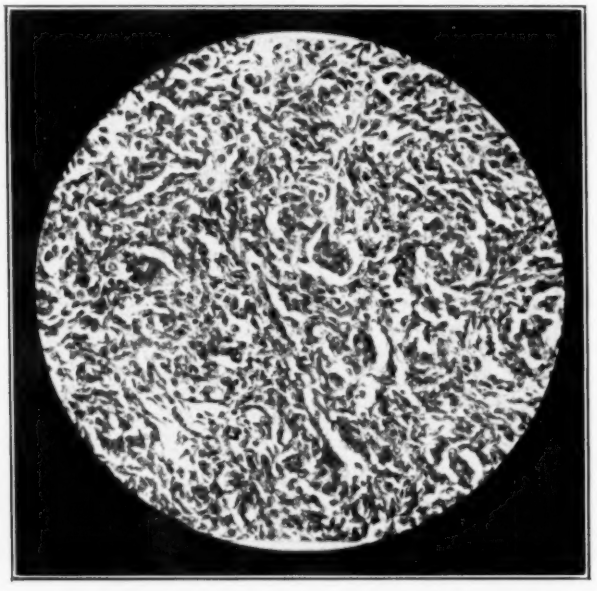

Fig. 19.—Adenoma tubulare testiculare sarcoma-like in structure.

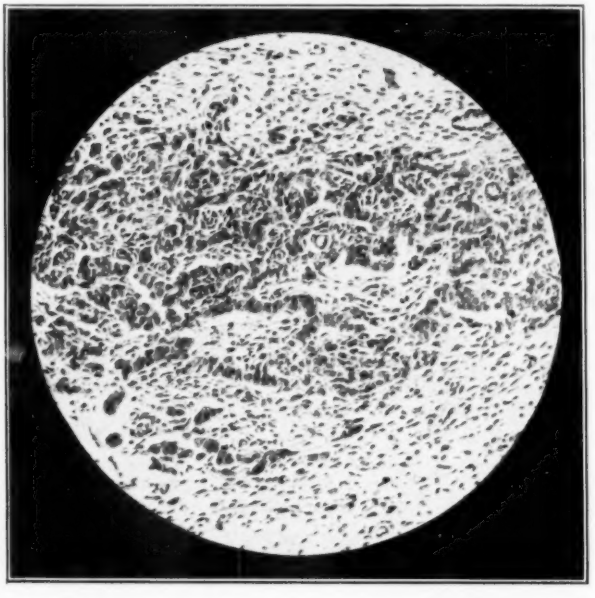

Fig. 20.—Adenoma tubulare testiculare with rudimentary cords.

arrhenoblastoma but the fact that the resulting masculinization confirms the theory of the origin of this newgrowth.

These tumors occur in two distinct morphologic forms and a third which holds an intermediary position. The first form is already

known as adenoma testiculare, so named by Pick, because it is not only similar to the adenoma developing in men in the testicle but also contains the same structures (Fig. 15).

As already mentioned, with this particular growth masculinization occurs only occasionally, in 3 out of a total of 9 cases so far reported.

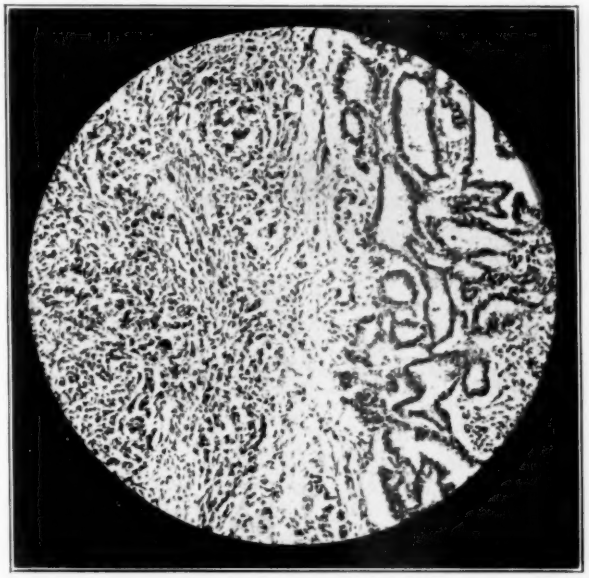

Fig. 21.—Adenoma tubulare testicularis with irregular tubules.

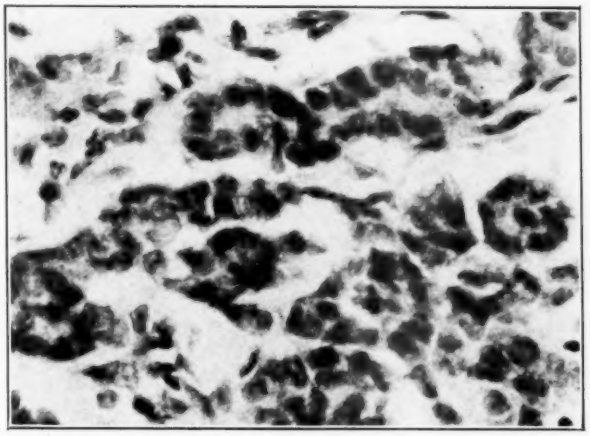

Fig. 22.—Adenoma tubulare testicularis with structures resembling seminal tubules.

I believe that the degree of masculinization depends in some way upon the extent of atypical proliferation of the newly developed tissue as testicular tissue. I wish to emphasize that one cannot assert, as was formerly done by Pick, that these adenoma necessarily originate from a true ovariotestis, because women afflicted with such tubular adenoma have not exhibited the signs of intersexuality since birth, as would be the case with all individuals having a real ovariotestis. Fur-

thermore, hermaphrodites with testicles or with ovariotestis have never been known to develop tumors which change their female characteristics toward masculinity.

Out of another class of tumors (11 cases), I had the opportunity to examine 9 which were associated with a high degree of masculinization. These epithelial tumors were quite atypical (Figs. 16, 17, and 18), often showing sarcoma-like structure (Fig. 19) but with rudimentary cords (Fig. 20) or consisting of irregular tubules (Fig. 21) which only rarely resemble seminal tubules (Fig. 22).

Notwithstanding marked differences between these two classes of tumors I believe that they have a common genesis. I can prove this on 6 other cases where the morphology varies from the one class (Fig. 23) to the other (Fig. 24). Women with this intermediary type of

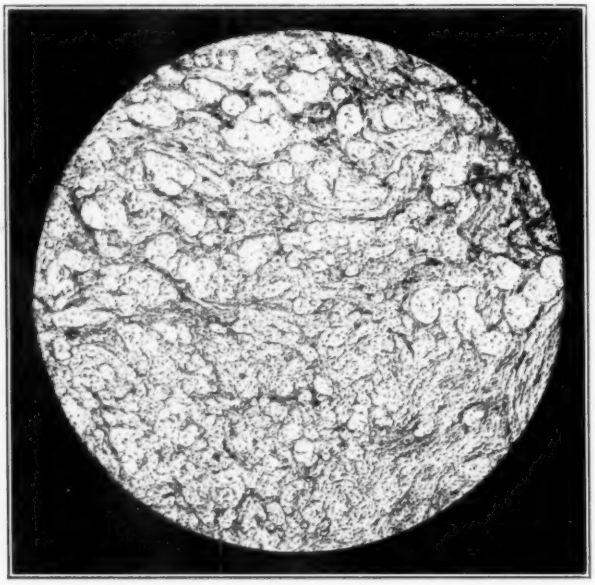

Fig. 23.—Arrhenoblastoma ovarii showing the features both of the adenoma of tubular type and of atypical epithelial growth.

ovarian tumor showed a slighter degree of masculinization than the others. They always lost their menstrual flows, sometimes they developed beards, male hirsuties and a deeper voice. I diagnosed these 6 cases of the intermediary type solely from the microscopic study of the neoplasm without knowing anything about history or physical findings. In all 6, later examination revealed the signs of defeminization and masculinization respectively.

Also in three specimens from the above mentioned atypical cases, which were shown to me by my colleagues, I immediately recognized the characteristic structures of the tumor and was able to state what the clinical findings would be.

Once again it must be stated emphatically that not all types of ovarian neoplasms exert a hormonal effect, i.e., are capable of de-

feminizing or of actually masculinizing the patients as formerly was thought, but only certain tumors which possess distinct morphologic and biologic characteristics.

It is of great importance for the gynecologist to know that patients afflicted with this type of newgrowth: disgerminoma, granulosa cell tumors, and arrhenoblastoma, are cured by operation in most instances and that it is not necessary to remove the opposite ovary if it is seemingly unaffected. However, the disgerminoma occurs bilaterally in 20.8 per cent of the cases. Even if the uterus was found involved in the process, operation leads to cure, though French writers speak of a high mortality in this disease. It certainly is unnecessary to remove prophylactically the other ovary in young persons. For this

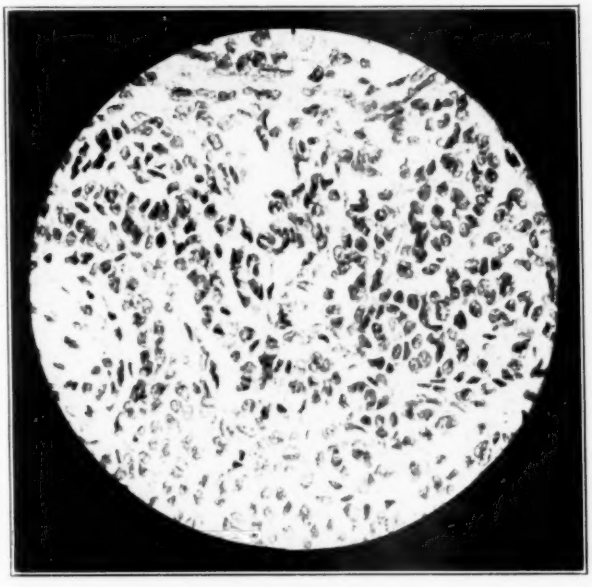

Fig. 24.—Same as Fig. 23.

reason alone it is important that the gynecologist learns to differentiate between these 3 forms of ovarian neoplasms even macroscopically.

It is essential to differentiate the signs of hermaphroditism from those of hypoplasia of the genital organs. In the cases of disgerminoma one must look for evidences of masculinization though such changes are common only with the arrhenoblastomas.

In conclusion, I will say that it has become most desirable to establish the hormonic activity so characteristic for these neoplasms in animal experiments, by transplantation, or injection of tumor extracts.

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THE SIGNIFICANCE OF INCOMPLETE FUSION OF THE MÜLLERIAN DUCTS IN PREGNANCY AND PARTURITION, WITH A REPORT ON 35 CASES*

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(From the Lying-In Hospital)

MOST gynecologists during a lifetime of practice encounter one or more patients having a so-called double uterus. Many obstetricians see one or more pregnant women who have a double uterus, and if by chance more than one such patient is seen within a short interval of time, the quite naturally expressed opinion is that these cases occur "fairly frequently." This paper is concerned only in the significance of incomplete fusion of the müllerian ducts in pregnancy and parturition.

* * *

Many of the cases reported are unusual in the situations encountered and in the methods by which they were handled. It is of interest that of 156 references on the subject reviewed by me, the conclusions were drawn from a single observed case in 102 instances, from 2 cases in 29 instances, from 4 cases in 16 instances and from 8 or more cases in only 9 instances. Many of these authors, however, also analyzed previously reported cases. Puddicombe[33] sounds the keynote of most of the case reports in stating that operative procedures are advisable in view of future pregnancies. Two recent authors,[22] reporting one case, have concluded, "Treat pregnancy in a double uterus as an unruptured ectopic; empty the uterus and correct the maldeveloped region. Be prepared for a severe postpartum hemorrhage and be ready for a stormy puerperium." This is not exactly in keeping with the impression to be gathered from the cases presented in this report.

* * *

It has been my privilege to collect from the records of 141,946 consecutive pregnancy patients at the New York Lying-In Hospital, from January, 1899, to July, 1930, 35 cases with double uteri, 19 of whom have come under my personal observation through the courtesy of the late Doctor Asa B. Davis. These 35 cases are reported in order of occurrence. The conclusions have been reached by comparison with normal patients. Where possible, the figures for comparison have been taken from the Annual Reports of the Hospital. Some comparison figures, which were not otherwise available, have been obtained

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Because of its length this paper cannot be printed in full in the Journal, but the complete article may be found in the author's reprints.

by analyzing 5,000 consecutive case records of pregnancy patients. These cases will be referred to as the Control Group. Where other controls are used, the source will be indicated. While admitting the obvious criticism, that 35 cases is a very small number from which to draw conclusions, it is hoped that the comparison with normal cases will warrant the conclusions reached.

(Detailed case reports may be found in the author's reprints.)

COMMENTS

Frequency of Occurrence.—It is somewhat confusing to note that all types of double uterus occurred once in 1,458 cases during the five and a half years of personal observation by the writer, whereas the record of 114,243 consecutive cases covering the period from January, 1899, to December, 1924, show double uteri occurring only once in 7,040 cases. It will be assumed that some cases either were not recognized, since the type of uterus can be determined only by intrauterine examination, or were not recorded. Several cases recorded as double uteri were clearly shown from the recording description to be simple bicornate uteri or uterus arcuatus and were not included in this series. It seems fair to conclude, however, because of the greater facilities for observation at present, that the probable frequency of occurrence of pregnancy in double uteri is about one in 1,500 cases. These figures give no definite conclusions as to the frequency of occurrence regardless of pregnancy, nor as to the comparative fecundity of women with double uteri.

TABLE I. FREQUENCY OF OCCURRENCE

NO. OF CASES IN SERIES	NO. CONSECUTIVE OBSTETRIC CASES	FREQUENCY
35	141,946 (January, 1899 to July, 1930)	1–4,055
16	114,243 (January, 1899 to December, 1924)	1–7,040
19	27,703 (January, 1925 to July, 1930)	1–1,458

Frequency of Occurrence of the Individual Types of Uteri.—The most frequently found types of double uteri (uterus bicornis subseptus unicollis vagina simplex, type 1) and the type illustrating the most complete failure of fusion of the müllerian ducts (uterus didelphys, type 3) show fairly constant frequency of occurrence, whether taken from the entire number of patients considered or from those under my personal observation. Of the other types there is a wide variation in the frequency of occurrence. It is evident that as types 2, 4, 5, 6, and 9 occurred only in the series under my personal observation that each type frequency of occurrence should be taken as the figure obtained from that series. As types 7 and 8 occurred so infrequently in the series and not at all in my personally observed series, the frequency of occurrence is taken as the figure obtained from the total series for these types. There was no case recorded of a rupture of a pregnant

horn of a double uterus and a careful review of the 125 ectopic gestations found, failed to reveal any hint that any one of these had been mistaken for a pregnancy in a horn of a double uterus. There was no case of uterus unicornis found. All of these types were classified after intrauterine examination.

TABLE II. TYPES OF UTERI WITH THEIR FREQUENCY OF OCCURRENCE

TYPES OF UTERUS	NO. IN 141,946 CASES	FREQUENCY	NO. IN 27,703 CASES	FREQUENCY
Bicornis subseptus unicollis vagina simplex	12	1–11,829	3	1–9,234
Bicornis unicollis vagina duplex	8	1–17,730	8	1–3,464
Uterus didelphys	5	1–28,389	1	1–27,703
Septus duplex bicollis vagina duplex	2	1–70,973	2	1–13,851
Duplex bicornis bicollis vagina simplex	2	1–70,973	2	1–13,851
Bicornis cum vagina duplex	2	1–70,973	2	1–13,851
Subseptus uniformis	2	1–70,973	0	
Subseptus unicollis cum septate vagina	1	1–141,946	0	
Bicornis unilatere rudimentaris vagina duplex	1	1–141,946	1	1–27,703

Classification and Comparison of Birthplace.—These percentages are obtained from the figures published in the Annual Reports of the Society of the Lying-In Hospital. If the years 1924-25 to 1929 alone are used for comparison, one is impressed with the high comparative percentage of Russian- and Italian-born patients having double uteri, but when the previous years, of which 1905, 1910 and 1915 seem a fair representation, are considered it is evident that the hospital clientele has undergone a changing character as to nationality, especially as to the diminishing proportions of Russians and Austrians and the increase of Italians. Even as far back as 1910 since which time the percentage of patients born in the United States and confined at

TABLE III. CLASSIFICATION AND COMPARISON* OF BIRTHPLACE

BIRTHPLACE	NO.	PER CENT OF TOTAL	PER CENT 1924 1925	PER CENT 1926	PER CENT 1927	PER CENT 1928	PER CENT 1929	PER CENT 1905	PER CENT 1910	PER CENT 1915
U. S. A.	5†	14.2	31.6	31.0	40.6	38.9	46.5	10.1	19.4	20.7
Russia	11	31.8	17.8	18.6	7.9	6.6	6.1	61.9	42.2	36.9
Italy	9	25.7	11.8	14.9	14.2	14.0	14.0	0.6	3.0	5.9
Austria	1	2.6	5.9	5.0	4.8	4.6	4.1	13.7	13.7	17.1
Spain	2									
Germany	2									
Roumania	1									
Ireland	2	25.7	32.8	30.5	32.5	35.4	29.3	13.6	21.6	19.4
Finland	1									
Greece	1									

*Comparison figures taken from Annual Report Lying-In Hospital.[28]
†One colored patient.

Lying-In Hospital has steadily increased, the comparison percentages of American-born patients exceeded constantly that of the double uteri series. Whether or not this is due to improved living conditions in this country is for speculation only.

Comparison of Number of Pregnancies, Age, Marriage Interval, and Incidence of Pregnancy.—The proportion of primiparae in the series exceeds that of the controls; the average age for primiparae is greater and for multiparae is less; the range of age compares favorably; the percentage over thirty years of age of primiparae is greater and of multiparae is less, the incidence of pregnancy is about the same; the interval between marriage and the birth of the first child is more than twice as great. As to fecundity there are no comparison figures available but we may assume, because of the greater average age of the primiparae, the greater the interval between marriage and the first childbirth in the double uteri series and because the incidence of pregnancy is about equal in the two series, that patients with double uteri show less tendency to become pregnant, but once having become pregnant the incidence equals that of normal individuals.

TABLE IV. COMPARISON OF SERIES WITH CONTROL SERIES AS TO NUMBER OF PREGNANCIES, AGE, MARRIAGE INTERVAL, AND INCIDENCE OF PREGNANCY

CLASSIFICATION	COMPARISON	TOTAL	PRIMIPARAE	MULTIPARAE
No. of cases	Series	35	19	16
	Control	5,000	1,982	3,018
Percentage	Series	100	54.2	47.7
	Control	100	39.7	60.2
Average age in years	Series	25.6	26.2	25.0
	Control	26.4	23.6	28.6
Youngest	Series	16	16	18
	Control	15	15	18
Oldest	Series	45	45	32
	Control	52	43	52
Number over 30 years	Series	8	6	2
	Control	1,261	242	1,019
Percentage over 30 years	Series	22.8	31.5	12.5
	Control	25.2	12.2	33.7
Marriage interval	Series 18 cases*	4.5 years		
	Special control†	2 years		
Incidence of pregnancy	Series	81	2.31 preg. per case	
No. cases including abortions	Control	11,386	2.27 preg. per case	

*Based on special control series.[29]
†Information available from only 18 cases.

Classification of Abortions and Comparison With the Control Series.—The percentage of abortions in the double uteri series is nearly 5 times as great as in the controls; the proportion of primiparae to multiparae in the series is as 3 to 2 whereas in the controls this proportion is as 3 to 4; the percentage of multiparae with previous abortions is higher in the series than in the controls. The multiparous breeches and abortions make up the entire percentage of cases in the double

uteri with previous abortions (no cases with vertex presentation in this series had had a previous abortion), whereas in the controls, the percentage of breeches with previous abortions is only slightly higher than that of cases with vertex presentations having had previous abortions. This suggests that the factors causing breech and transverse presentations also cause abortions, especially in double uteri. The percentage of patients with more than one previous miscarriage was more than three times that of the control series; the percentage of total miscarriages in the total number of pregnancies is nearly twice as great in the double uteri series as in the controls. Noting from Table IV that the incidence of pregnancy was about equal, it is significant that the number of pregnancies for each abortion is less in the series than in the controls, though the series figure is well within the limits of the estimated figures of Malins and Taussig. An evident conclusion is that double uteri have an increased tendency to abortion and it seems probable that this tendency is greatest in the types resulting in breech or transverse presentation.

TABLE V. CLASSIFICATION OF ABORTIONS AND COMPARISON WITH CONTROLS

CLASSIFICATION	SERIES		CONTROL		COMPARISON		
	NO.	PER CENT	NO.	PER CENT	Williams	Malins	Taussig
Total abortions	5	12.8	149	2.9			
Primiparae abortions	3	60.0	63	42.2			
Multiparae abortions	2	40.0	86	57.7			
Multiparae with previous abortions	8	50.0	955	35.9			
Multiparae breeches with previous abortions	6	47.7*	42	34.1†			
Multiparae vertices with previous abortions	0	0	891	31.3‡			
Multiparae abortions with previous abortions	2	100	22	25.5§			
Patients with more than one previous abortion	5	38.4	325	12.2			
Total number of pregnancies past and present	81	100	11,386	100			
Total miscarriages past and present	19	23.45	1,657	14.5	6.0%	19.23%	30.0%
Number of pregnancies for each abortion	4.2		6.8		16.6	5.0	3.3

*Percentage of total multiparous breeches (13) in series.
†Percentage of total multiparous breeches (123) in controls.
‡Percentage of multiparous abortions.
§Percentage of multiparous vertices.

Comparison as to the Period of Gestation and Weight of Babies.— Here is shown that the percentage of ten months' gestation is considerably smaller and that of the nine months' gestation is considerably larger in the double uteri series than in the control group; the percentage of eight and six months' gestations are fairly constant in the series and in the control group.

The average weight, the percentages of babies weighing more than 3,200 gm. and more than 2,800 gm. respectively, are considerably less than comparison figures for the control group; also and quite naturally, the percentages of babies weighing less than 2,800 gm. and less than 2,000 gm. respectively, are greater for the series than for the control group.

TABLE VI. COMPARISON AS TO PERIOD OF GESTATION AND WEIGHT OF BABIES

CLASSIFICATION	SERIES		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Total number babies	34*	100	4818†	100
10 months' gestation	14	41.2	3458	71.7
9 months' gestation	15	44.1	953	19.7
8 months' gestation	2	5.8	244	5.0
7 months' gestation	2	5.8	65	1.3
6 months' gestation	1	2.9	98	2.0
Total number babies	34	100	4912‡	100
Average weight in gm.	2991		3337	
Babies over 3200 gm.	16	47.0	2898	59.3
Babies over 2800 gm.	24	70.5	4289	87.3
Babies under 2800 gm.	10	29.4	623	12.7
Babies under 2000 gm.	3	8.8	95	1.9

*Total 34 = 39 pregnancies, 5 abortions.

†Total 4,818 = 5,000 patients including 59 twins and one triplets, 149 abortions, 92 cases in which period of gestation not known.

‡Total 4,912 = 5,000 patients including 59 twins and one triplets, 149 abortions.

Side of Uterus Containing Fetus.—In only 30 pregnancies was the side known, and from the figures of this series it would seem that there is a slightly greater tendency (4 to 3) to pregnancy in the right side. The one case of twins had one baby in each side; two patients delivered twice, had the pregnancy alternating; one patient delivered twice had the pregnancy in the same side each time. The position of the presentation showed a slight tendency (4 to 3) to be the same as the side of the uterus occupied.

TABLE VII. CLASSIFICATION OF PREGNANCIES AS TO THE SIDE OF UTERUS CONTAINING THE FETUS

SIDE OF UTERUS CONTAINING PREGNANCY	NUMBER OF PREGNANCIES
Left side only	12
Right side only	16
Both sides (1 set twins)	2
Total pregnancies available	30
Side not known	9
Alternating sides (2 cases)	4
Position same as side of uterus	12
Position and side of uterus opposite	9

Classification of the Side of the Uterus Having the Placental Site and Comparison With the Control Group as to Manual Removal of the Placenta.—It is consistent with Table VI that there should be a slightly increased tendency for the placenta to be in the right side of

the uterus. In the one case of twins both sides of the uterus had placental sites. In 4 cases the placental site was central. The side alternated in 2 cases delivered twice and was the same in one case delivered twice. In 4 cases the placenta was also located on the septum of the uterus. In 1 case the placenta was on one side and the baby on the other. In comparing the percentages requiring manual removal of the placenta, the percentage in the double uteri series greatly exceeded that of the control group. However, the proportion of those placentas removed for bleeding to those for adherent placentas was 1 to 4.5 for the double uteri series, whereas in the control group twice as many cases had a manual removal for bleeding as for adherent or retained placentas.

TABLE VIII. CLASSIFICATION OF THE SIDE OF UTERUS FOR PLACENTAL SITE AND COMPARISON WITH CONTROLS, AS TO MANUAL REMOVAL OF THE PLACENTA

CLASSIFICATION: SIDE OF UTERUS	SERIES			CONTROL		
	NO. PLACENTAS	NO. CASES	PER CENT	NO. PLACENTAS	NO. CASES	PER CENT
Left side only	11					
Right side only	17					
Both sides (1 set twins)	2					
Central	4					
Total available sites	34					
Side not known	5					
Alternating sides (2 cases)	4					
Placenta also located on septum	4					
Placenta on 1 side: Baby on other	1					
Manual removal of placenta, excluding abortions and cesarean sections	11	29*	37.9	27	4772†	0.57
Manual removal for bleeding	2	29	6.8	18	4772	0.37
Manual removal for retained placenta	9	29	31.0	9	4771	0.19

*Placentas in series minus 5 abortions and 5 cesarean sections.
†5,061 placentas minus 149 abortions and 139 cesarean sections in control series.

TABLE IX. CLASSIFICATION AS TO PRESENTATION COMPARED WITH THREE CONTROL GROUPS

LYING-IN SERIES							COMPARISONS			
CLASSIFICATION	TOTAL		PRIMIPARAE		MULTIPARAE		SOURCE	TOTAL CASES	NO. BREECHES	PER CENT
	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT				
Total babies	39*	100	19		20		(25) Pinard	100,000	3,301	3.3
Breech	21†	53.8	8	42.1	13	65.0	(27) N. Y. L.-I.	5,457	140	2.5
Vertex	13	33.3	8	42.1	5	25.0	1924			
Abortions	5	12.8	3	15.7	2	20.0	Control	5,061‡	176	3.4

*3 Patients in series delivered twice, 1 twins = 4 additional babies, total 39.
†6 Breeches were really transverse.
‡5,000 Patients plus 59 twins plus 1 set triplets.

Classification as to Presentation Compared With Three Control Series.—It is evident from this table that the frequency of breech or

transverse presentations in double uteri is out of all proportion to their frequency in the three groups used for comparison.

Classification of Previous Presentations in Multiparae.—Of the multiparae in the double uteri series, 75 per cent had had breech presentations.

TABLE X. CLASSIFICATION OF PREVIOUS PRESENTATIONS IN MULTIPARAE

CLASSIFICATION	NO.	EXPLANATION OF PREVIOUS DELIVERY
Total multiparae in series	16	
Total babies of multiparae	20	3 patients delivered twice 1 twins
Multiparae with breech when first delivered at New York Lying-In Hospital	9	
Breech cases having at least 1 previous breech	4	Para 5 All breech cases Para 6 1 vertex, 1 breech, 3 miscarriages
Breech cases having more than 1 previous breech	3	Para 7 All breech cases Para 4 1 breech, 1 vertex, 1 breech
Breech cases not having 1 previous breech	5	Para 8 4 miscarriages, 3 normal vertex Para 2 Vertex Para 2 Normal vertex Para 3 2 miscarriages Para 6 1 normal vertex, 4 miscarriages
Vertex at first delivery at Lying-In Hospital	5	
Vertex with previous breech	3	
Vertex not having a previous breech	2	Para 4 3 normal vertex Para 3 2 normal vertex
Incomplete abortions at first delivery at Lying-In	2	Para 2 Both miscarriages Para 5 2 normal vertex, 2 miscarriages
2 abortions 2 vertices		Had no breech at any time = 25 per cent of total
		75 per cent of multiparae had a breech at some time

Classification and Comparison as to Duration of Labor.—The average duration of labor for the 23 available cases of the double uteri series, including 13 primiparae, was several hours longer than the corresponding figures for the control group, but the average for multiparae in both groups was the same. The fact that 65.1 per cent of the double uteri series had dry labors, as compared with 20.7 per cent for the control group may partially explain the longer duration of labor. The average duration of labor for breech presentation in the double uteri series was shorter than the average for the total series, whereas in the control group it about equalled the total average, so the increased duration cannot be explained by the large proportion of breech presentations in that series.

Comparison as to Methods of Delivery.—The classification is in three groups; breech and vertex presentation and abortions, to which is added a collective classification and comparison. The total percent-

TABLE XI. CLASSIFICATION AND COMPARISON AS TO DURATION OF LABOR

CLASSIFICATION	NO. CASES	TIME	COMPARISON TIME			
			WILLIAMS	VEIT	CONTROL	NO. CASES
Total	35					
Average time of labor	23	20 hr. 25 min.			15 hr. 30 min.	4,695
Not in labor	2					
Duration of labor not known	5					
Duration labor in abortions	5	Not known				
Average duration labor, primiparae	13	25 hr. 25 min.	18 hr.	20 hr.	19 hr. 8 min.	1,982
Longest primiparous labor	1	57 hr. 25 min.				
Shortest primiparous labor	1	8 hr.				
Average duration labor, multiparae	10	13 hr. 12 min.	12 hr.	12 hr.	13 hr. 10 min.	2,713
Longest multiparous labor	1	36 hr.				
Shortest multiparous labor	1	1 hr.				
Dry labor	15 (65.1%)	27 hr. 10 min.	*		19 hr. 36 min.	956 (20.7%)
Average duration breech labor	16	18 hr. 18 min.			15 hr. 36 min.	168

*Williams: 1 dry labor to each 10 labors (10 per cent).

ages in each group are taken as the percentages of the entire number of pregnancies in that series; the other percentages are of the total number of pregnancies in that group for each of the series.

In the double uteri series all of the cesarean sections were performed for contracted pelves, whereas the control group included those performed for other causes (placenta previa, etc.). The markedly higher percentage of cesarean sections in the series seems to indicate a greater incidence of contracted pelves in patients with double uteri. The proportion of cesarean sections in breech and vertex presentations is practically the same in the corresponding series and group.

In the group presenting by breech the percentage of deliveries by breech extraction is lower than in the controls owing to the tendency to contracted pelves requiring cesarean section delivery.

In the group presenting by vertex the percentage of spontaneous deliveries is considerably lower than in the control group.

The operative deliveries for the control group include a large proportion of low forceps while there were no such cases in the double uteri series.

The incidence of abortion, as in Table V, is considerably higher than in the controls.

In the comparison as to all presentations (excluding abortions), the percentage of operative deliveries is 4.5 times that of the control group, owing largely to breech extractions and cesarean sections due to contracted pelves. However, when all version and forceps deliveries are compared, the percentage is about equal.

TABLE XII. SERIES AND CONTROLS COMPARED AS TO METHOD OF DELIVERY

PRESENTATION	METHOD OF DELIVERY AND CLASSIFICATION	PATIENTS	SERIES PREGNANCIES		CONTROL PREGNANCIES	
			NO.	PER CENT	NO.	PER CENT
Total	Deliveries		39	100.0	5,061	100.0
Breech	Total deliveries		21	53.8*	176	3.4*
Per cent taken of total breech cases	Cesarean section (1 patient delivered twice)		3	14.2	5	2.8
	By breech extraction		18	85.7	171	97.1
	Accouchement forcé	4				
	For (a) Delayed labor	2				
	(b) Prem. sep. placenta	1				
	(c) Prolapsed cord	1				
Vertex	Total deliveries		13	33.3*	4,736	93.5*
Per cent taken of total vertices	Spontaneous		7	53.8	4,053	86.5
	By all types of operative delivery		6	46.1	683	14.4
	Cesarean section		2	15.3	134	2.8
	(a) Funnel pelvis with fibroid	1				
	(b) Hydrocephalus	1				
	High forceps		2	15.3	10	0.2
	(a) Second twin delayed labor	1				
	(b) Delayed labor, attempted version	1				
	Medium A forceps for delayed labor (57 hr.)		1	7.7	114	2.4
	Version and extraction		1	7.7	100	2.1*
Abortions	Total		5	12.8*	149	2.9*
	Curettage and packing for incomplete abortion	4				
	Anterior vaginal hysterotomy for inevitable abortion	1				
All except abortions	Total deliveries		34		4,912	
	All operative deliveries†		27	79.5	859	17.7
	Version and forceps		4	11.7	544	11.0
	All cesarean sections		5	14.7	139	2.8

*Per cent taken of total deliveries.
†Including breech extraction.

Comparison of Series and Controls as to Maternal Mortality and Morbidity.—There was one death in the double uteri series which gives a high mortality percentage when compared with the controls. This death in a gravida 6, para 2, was due to shock following accouchement forcé and breech extraction for premature separation of the placenta with concealed hemorrhage which had started with a definite history of trauma eight hours before admission to the hospital. Because of the rarity of this condition 27,703 consecutive cases were used as the basis for estimating the incidence of concealed hemorrhage. While premature separation of the normally situated placenta was found to occur 141 times or once to 196 cases, there were only 11 cases that showed more than a simple marginal separation, and only 3 cases of concealed hemorrhage in 27,703 consecutive cases; giving an incidence of one in 9,234 cases. The mortality in these 3 cases was 33.3 per cent. Because the incidence of occurrence in the controls is so slight and because the number of consecutive cases for each concealed hemorrhage is so much greater than the total number of the double uteri series it seems hardly fair to compare the two groups.

TABLE XIII. SERIES AND CONTROLS COMPARED AS TO MATERNAL MORTALITY AND MORBIDITY

COMPARISON	SERIES			CONTROLS		
	NO.	NO. CASES	PER CENT	NO.	NO. CASES	PER CENT
Maternal mortality	1	35	2.8	21	5,000	0.42
Death from concealed hemorrhage	1	1	100.0	1	3*	33.3
Maternal morbidity	12	39	30.7	248	5,000	0.7
Intrauterine manipulation†	39	39	100.0	398	5,061	7.9
Uterine packing‡	6	29	20.7	34	4,773	0.7
Cesarean section morbidity	3	5	60.0	22	139	15.8
Abortion morbidity	1	5	20.0	15	149	10.0
Morbidity of operative delivery per vaginam§	5	6	83.3	58	544	10.6
Morbidity of nonoperative deliveries§§	3	25	12.0	153	4,053	3.7
Morbidity of cases with intrauterine manipulation	12	39	30.7	61	398	15.3

*3 Cases of concealed hemorrhage in 27,703 cases or 1 to 9,234 cases.
†Including cesarean sections and abortions.
‡Excluding cesarean sections and abortions.
§Breeches and abortions not considered as operative deliveries.
§§Breeches included.

The maternal morbidity is higher in every respect studied than in the controls. This is probably explained by the fact that all the double uteri cases had intrauterine examinations and 20 per cent had packing. The incidence of morbidity increased markedly in the control group cases that had intrauterine manipulations.

Comparison as to Fetal Mortality.—The series showed proportionally fewer viable babies, many more abortions, and a higher percentage of

stillbirths than the control group, also an increase of monsters, especially hydrocephalic monsters. Even excluding the two stillbirths, both hydrocephalic monsters, and the two infant deaths due to prematurity, we still have, with the one death resulting from an obstetric injury, a mortality of 2.8 per cent. This is higher than that of the controls, which includes infant deaths from all causes. The percentage of stillbirths in vertex presentation in the double uteri group is about double that of the control group, but for breech presentation, the series stillbirth percentage is practically one-fourth that of the control group, though excluding macerates and neonatal deaths, the breech stillbirth incidence for the control group was about 12 per cent. This suggests an easy breech delivery in patients with double uteri, probably due to the tendency to prematurity. The fetal mortality is about three times as great in the double uteri series as in the controls.

TABLE XIV. FETAL MORTALITY COMPARED IN SERIES AND CONTROLS

CLASSIFICATIONS	SERIES		CONTROLS	
	NUMBER	PER CENT	NUMBER	PER CENT
Total pregnancies	39	100.0	5,061	100.0
Viable babies	34	87.1	4,912	97.0
Abortions	5	12.8	149	2.9
Stillbirths exclusive of abortions	2	5.1	183	3.6
1. Craniotomy on hydrocephalic breech				
2. Cesarean section on hydrocephalic				
Infant deaths (first 10 days)	3	7.6	99	1.9
1. Prematurity (breech, 6½ months)				
2. Prematurity (vertex, 7 months) after 1 day				
3. Vertex, cranial hemorrhage after 2 days. High forceps				
Vertex, stillbirth	1 (13 cases)	7.6	153 (4,736* cases)	3.2
Breech, obstetric stillbirth	1 (21 cases)	4.87	30 (176* cases)	17.0‡
Fetal mortality (excluding abortions)	5	14.2†	282	5.8†
Total mortality (including abortions)	10	25.6	431	8.5
Monsters	2	5.1	24	0.47
Hydrocephalic monsters	2	5.1	4	0.007

*Including prematures.
†Percentage taken of viable babies.
‡Including macerates and neonatal deaths.

Treatment of Deformity.—If one considers that in this series 74.2 per cent of the patients required and received no treatment for the deformity, that 17.1 per cent had simply a resection of the vaginal septum and that only 8.5 per cent had corrective operative procedures with somewhat questionable results, the prevailing opinion of most authorities, namely, that radical procedures for correction of the deformity should be indulged in when the deformity is discovered, seems to be grossly exaggerated.

Three patients were operated upon for other than simple resection of the vaginal septum. The first patient had an attempted elimination of the septum and bicornate character of the uterus by anterior vaginal hysterotomy and plastic at the time of curettage for inevitable abortion. The operation was difficult, the records lead one to suspect it was not satisfactorily completed and there is no available record of a later successful pregnancy.

The second patient (previously reported [30]) had a septum extending to, but not adherent to the fundus. The baby was delivered by breech extraction from the left side and the placental site was on the right side. The placenta was delivered by Credé and the cord was found to be held by the uterine septum. The cord was cut at one side within the vagina and traction exerted in the other portion of the cord. The septum was severed but the cut edges not sutured. The uterus was packed with iodoform gauze. A septum of the vagina had been resected at a previous breech delivery. No record of a later pregnancy is available.

The third case did seem benefited by her operative procedures for after 2 nonviable premature labors, each a breech presentation, at the second of which the vaginal septum was resected and later an abdominal hysterotomy with resection of the uterine septum was performed, this patient was delivered spontaneously of a seven months', 1880 gm. baby, presenting by vertex after labor had been induced by violent trauma. The fact that this baby died after one day and that the mother, having contracted gonorrhea resulting in pyosalpinx and later requiring abdominal salpingectomy, has had to my knowledge no further pregnancies, does not affect the evidence that after the operation she gave birth to a viable and normally presented baby.

TABLE XV. TREATMENT OF DEFORMITY

CLASSIFICATION OF TREATMENT OF DEFORMITY	NO.	PER CENT
Total number of mothers	35	100.0
No treatment for deformity	26	74.2
Simple resection of vaginal septum	6	17.1
Attempted elimination of horn by vaginal anterior hysterotomy	1	8.5
Resection of uterine septum and packing	1	
Resection of vaginal septum at delivery. Abdominal hysterotomy and resection of uterine septum at later date	1	

Previous Operation.—Four patients reported previous operations; one a resection of a vaginal septum at a previous delivery, the other three laparotomies, one of which was for the removal of an ovarian cyst, the others exploratory on the mistaken diagnosis of ectopic pregnancy.

TABLE XVI. CLASSIFICATION OF PREVIOUS OPERATIONS

TYPE OF OPERATION	NUMBER OF CASES
Total	4
1. Removal of ovarian cyst at four months. Para 2. Bicornis uterus with 1 miscarriage. Later had transverse. Later 1 vertex.	
2. Exploratory celiotomy for ectopic sixteen years before pregnancy. Nothing done. Para 1. Forty-five years. Breech.	
3. Removal of septum of vagina at previous delivery. Para 6 with 4 miscarriages and 1 normal vertex. Simple uterus bicornis unicollis at breech delivery.	
4. Exploratory celiotomy for ectopic at five months. Nothing done. Para 3 with 2 miscarriages.	

CONCLUSIONS

1. Double uterus of some type, exclusive of simple septate vagina and uterus arcuatus, was found about once in each 1,500 pregnancies in this series of cases. No case of rupture of the pregnant horn of a double uterus was found.

2. Foreign-born patients show a greater tendency than American-born.

3. Patients with double uteri show less tendency to become pregnant, but once having become pregnant, the incidence is equal.

4. There is an increased tendency to abortion, especially in types showing breech and transverse presentation.

5. There is greater liability to premature labor.

6. The right side is occupied more frequently than the left, though in patients with more than one pregnancy, alternate sides may be occupied. Twins may occupy both sides. The position of the presenting part is likely to be as the side occupied.

7. The placental site is more often right than left. There is marked increase in the necessity for manual removal of the placenta, but the popular opinion of the great tendency to postpartum hemorrhage has apparently been greatly exaggerated.

8. There is greatly increased frequency of breech and transverse presentations.

9. The average duration of labor is greater for primiparae but about equal for multiparae. The frequency of dry labor may explain the prolonged duration.

10. The tendency to contracted pelves results in an increased incidence of cesarean sections. Greater number of breech presentations gives an increased operative incidence, if breech extraction is regarded as an operative delivery. Excluding these two forms of delivery there was no increased operative incidence.

11. Maternal mortality is comparatively high.

12. Increased maternal morbidity is to be expected, probably because of the maneuvers required for diagnosis of the condition and for delivery, rather than because of the condition per se.

13. There is a higher rate of fetal and infant mortality, abortions and stillbirths, a lower percentage of viable babies and an increased tendency to hydrocephalic monsters.

14. The necessity for operative correction has been greatly exaggerated.

15. A double uterus may be mistaken for an ectopic gestation, whether or not the patient is pregnant.

16. Patients with double uteri may have other gynecologic conditions requiring operation during or before gestation.

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107 EAST SIXTY-SEVENTH STREET.

(For discussion, see page 798.)

ABORTION IN RELATION TO FETAL AND MATERNAL WELFARE*

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ANALYSIS

I. *Introduction:*
- (1) Definition of abortion.
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II. *Frequency of Abortion:*
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- (3) Relation to confinements.
- (4) Relation to marriage.
- (5) Relation to multiparity and age.
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III. *Cause and Prevention of Abortion:*
- (1) Spontaneous (trauma, infection, syphilis).
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  - (a) Legislation.
  - (b) Birth control.
  - (c) Education.

IV. *Maternal Mortality of Abortion:*
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  - (3) Relation to manner of abortion.
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- B. Cause of Maternal Deaths:
  - (1) Spontaneous and therapeutic cases (lack of asepis and proper training of physicians, ignorance of patients, lack of hospital facilities).
  - (2) Induced cases (under-cover conditions, fear of exposure, type of abortionist).
- C. Ways of Reducing Maternal Mortality:
  - (1) Better training of physicians.
  - (2) Research on treatment of infection.
  - (3) The Russian experiment.

V. *Maternal Morbidity After Abortion:*
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- (2) Sterility.
- (3) Subsequent labors.
- (4) Psychic effects.

VI. *Summary.*

*Prepared for the White House Conference, Committee on Prenatal and Maternal Care, Subcommittee on Factors and Causes of Fetal, Early Infant and Maternal Morbidity and Mortality, Hugo Ehrenfest, M.D., St. Louis, Chairman.

I. INTRODUCTION

The term abortion as used in this paper, will denote the pre-viable expulsion of the human ovum. It will include all cases from the earliest conceptions to the twenty-eighth week of fetal life, regardless of the factors that may have led to the interruption of pregnancy. I have avoided the term "miscarriage," or any attempt to distinguish between early and late cases.

The significance of the abortion problem to our race can best be realized when we stop to figure that out of 1,000,000 human beings that are conceived, between 300,000 and 400,000 perish in the first six months of their intrauterine existence by abortion, that about 100,000 more die from that time to the completion of the first year of life, and that the remainder perish in various smaller amounts through the eight or nine decades of human existence. It may be claimed, to be sure, that the minute embryo in its first few weeks of development is not to be put in the balance against a fully developed adult human being; but the tremendous numbers of the former certainly make the problem a very real one. The sword of abortion, however, is double-edged in its destructiveness. It kills not only the impregnated ovum within the womb, but often takes as well the life of the young mother. It is appalling to note that in the childbearing years from fifteen to forty-five, in that epoch when mothers are most needed for the care of their young children, this scourge of abortion is responsible for deaths almost equaling those from childbirth. Heynemann has found abortion and its sequelae the most common cause for hospitalization in the gynecologic wards. It is this combination of a maternal with a fetal mortality that makes it of special significance.

Accurate statistical information on the subject of abortion encounters innumerable obstacles. This is due not merely to the fact that in the early abortions there is considerable diagnostic difficulty, but more especially to the efforts of the patients to conceal the truth, for fear of scandal or criminal prosecution. We find therefore that even in Germany with its accurate health statistics there is the greatest variance in the estimates as to the number of abortions. Some give the figures as 300,000, others as over a million annually. All attempts to register abortions as we do births has met with failure. Only a small percentage of them are so recorded. Only in Russia, where abortions are legalized, can we expect to find any appreciable percentage of cases recorded. And these Russian figures are of course only to a limited degree applicable to American conditions. In the city of Magdeburg, Germany, the Department of Health has made a most comprehensive special survey of all abortions for the period from 1924 to 1927. This report dealt not merely with the cases treated in clinics and hospitals. In fact they found that *only one-third* of all abortions in Magdeburg were thus treated, so that any data concerned

merely with hospital cases would have given a wrong impression. Reports from the German Krankenkassen (health insurance societies) throw an interesting light on the extent to which subterfuge by patients and doctors may conceal true figures. Among 100,000 women members of the Leipzig and Berlin health insurance societies, the reports indicated a striking difference in the number of women claiming incapacity for abortion and puerperal hemorrhage:

Leipzig,	642 abortions;	425 hemorrhages
Berlin,	2,418 abortions;	15 hemorrhages

The large number in Leipzig who claimed hemorrhage as a cause of disability clearly indicated that in that city numerous abortions had been classified under that head in order to conceal the truth. Physicians are inclined to gloss over the truth, since a statement of the true facts may involve serious consequences for their patients. Since fear of exposure plays so important a part in concealing the truth regarding abortion, more accurate data are usually obtainable by a careful history of the past pregnancies of the patient rather than by an enumeration of the abortions at the time of occurrence. If a year or two has elapsed since the abortion, the patient, especially if she is married, will not hesitate to tell the truth. I have frequently had patients tell me, without any persuasion, that they had as many as seven or more induced abortions. In what is to be said subsequently I trust the reader will appreciate all these difficulties and realize that I have tried to hit as close to the true mark as conditions permit.

II. FREQUENCY OF ABORTION

General Statistics.—The best statistical evidence on the subject of abortion in the United States has come from the investigations of the Children's Bureau of the United States Department of Labor, which analyzed 7,380 maternal deaths in 15 states occurring in 1927-28. This report will be considered subsequently under the head of maternal mortality. Dr. Frances C. Rothert, who analyzed these figures, stated in a communication to me that the department had absolutely no data on the frequency of abortions in this country. Hospital and dispensary figures are of course entirely inadequate in giving an idea of the frequency of this condition. It might be of interest to note that in such institutions in the city of New York, the Department of Health recorded 1,350 cases in 1926, 1,783 cases in 1927, 2,380 cases in 1928, 2,568 cases in 1929, and 2,313 cases in 1930. This included only illegal operations and not the spontaneous abortions. Dr. S. Dana Hubbard, from whom these figures were obtained, writes me that in the opinion of an eminent gynecologist in New York approximately 100,000 abortions occurred annually in that city. I was however unable to obtain any positive evidence of a marked increase in

the abortion rate during the past fifteen years corresponding to that which has apparently taken place in some of the European countries. Doubtless the more stable social and economic conditions present in this country have been a determining factor. The rapid growth, however, of our urban districts as against the rural districts must have produced some increase in the abortion ratio, since the figures throughout the world concur in the greater incidence of abortion in cities as against country districts. If we try then roughly to estimate the total number of abortions that occur annually in this country we can, I believe, justly assume a minimum ratio of one abortion to two and one-half confinements* in the cities and a ratio of 1 abortion to 5 confinements* in the country districts. On the basis of 2,500,000 confinements annually in the United States, distributed 40 per cent in the cities and 60 per cent in the country districts, we obtain a total figure of approximately 700,000 abortions annually. This is certainly rather an underestimate than an overestimate of the actual condition.

Abortion may be divided in its etiology into three groups: (1) spontaneous, (2) therapeutic, and (3) criminally induced. Authorities both here and abroad agree that of the three types the most common is that of criminal abortion. The proportion as given in the Children's Bureau, maternal mortality statistics is 37 per cent spontaneous, 13 per cent therapeutic and 50 per cent criminal, out of a total of 1,587 maternal deaths in which the necessary data were available. In the larger cities the percentage of criminal abortions runs as high as 75 to 80 per cent. Heynemann, for 1922, gives the percentage of such abortions in Berlin as 89 per cent, Munich 66 per cent, and Hamburg 70 per cent. In the country districts this percentage is somewhat less. Plass in a questionnaire answered by 81 country practitioners in Iowa and surrounding states with a maternity experience of approximately 51,000 deliveries found that abortions were divided into 34.1 per cent spontaneous, 4½ per cent therapeutic, and 61.4 per cent criminal.

Relation to Population.—Ordinarily the ratio of abortion is given on a basis of the total population of a certain city or district. Roesle shows that these figures do not give a correct picture inasmuch as the influx of large numbers of young people to the cities brings about a greater percentage of women in the childbearing years in such communities. These figures are particularly valuable when we try to make comparison between two periods of time. Thus in the city of Magdeburg, Germany, where a careful survey was made in 1912 and again in 1927 the ratio of abortion based on the total population showed a decline that was not as great as when the figures were based upon the number of women between fifteen and forty-five years of

*See paragraph "Relation to Confinements" for data.

age. He calls this the pre-fertility ratio and Table I shows that there is a definite difference between the two methods of calculation.

TABLE I. PRE-FERTILITY RATIO OF ABORTION (MAGDEBURG)

YEAR	TOTAL POPULATION IN THOUSANDS	TOTAL OF ABORTIONS		NUMBER OF WOMEN BETWEEN 15 AND 45 YEARS IN THOUSANDS	RATIO OF ABORTIONS IN RELATION TO A THOUSAND SUCH WOMEN
		ABSOLUTE FIGURES	RATIO TO TOTAL POPULATION		
1912	288	1458	5.1	72	20.3
1927	298	1448	4.9	81	17.9

For the city of Berlin, Roesle calculates that the pre-fertility ratio was 31 per thousand in 1926 and 33 per thousand in 1927. When we compare the figures for Berlin in 1927 with those for Magdeburg we see that in that year the ratio was almost twice as large in Berlin. This corresponds with the general belief that induced abortions are particularly prevalent in the large metropolitan centers. From Russia we have accurate figures on the population of Leningrad, and in the year 1926 we find that 21,646 abortions were registered, a ratio of 44 per thousand women between fifteen and forty-five years of age. While these figures exceed those of Berlin, the difference may be an apparent rather than a real one, since doubtless large numbers of criminal abortions were not recorded in the Berlin calculations.

Engelsmann, in extensive statistics from the city of Kiel, contended that there is no decrease in the number of pregnancies but that the decrease in the birth rate is counterbalanced by the increase in abortions. Specially significant is the decrease in the number of children among fertile families and also the fact that while in the laboring classes the percentage of births is still the highest it also contains the highest percentage of abortions.

This influence of abortions upon the birth rate has been emphasized with some justice in Russian statistics. Dr. A. B. Genss, the official statistician on this subject, points out that while the birth rate in England dropped from 28.4 per thousand in 1910 to 16.7 per thousand in 1927 (a decrease of 41 per cent), while in Germany it has in the similar period dropped from 34.7 to 18.3 (a decrease of 47 per cent), and while all the other European countries showed a similar decline, the Russian birth rate had only declined from 47.2 per thousand in 1910 to 44 in 1927, thus remaining by far the highest for all Europe. He points out that legalization of abortion has not produced in Russia any material decline in the population rate. In illustration of this he compares the figures from Moscow in 1913 with those for 1926. In 1913 the birth rate was 32.3 per thousand while in 1926 it was 28.9 per thousand. On a basis of 2,019,453 population in 1926 a continuence of the birth rate of 1913 would have produced 66,000 children. In fact 58,384 children were born that year. There remains, therefore,

a deficit of 7,000 children or 3.4 per thousand. Now the index of abortions was 15.8 per thousand in 1926 in comparison with 2.9 per thousand in 1913. If we add the 2.9 per thousand of 1913 to the 3.4 per thousand which represents the true increase in abortions, we get 6.3 per thousand as against 15.8 actually observed. The difference between these two figures, amounting to 9.5 per thousand abortions, with some justice he interprets as the correct figures for the *secret unregistered* abortions. His claim, therefore, is that, instead of there being over five times as many abortions in 1926 as compared with 1913, the true increase with legalized abortion amounted to but 3.4 per thousand, approximately 30 per cent. Genss' figures are of course based on the assumption that there has been no increase in the percentage of conceptions, and if we consider the extensive birth control propaganda in Russia, we can I believe fairly assume that, even in spite of laxer moral conditions, there has been no increase in the ratio of conceptions.

Relation to Confinements.—Williams in his Textbook states that the ratio of abortions to confinements is 1 to 4 or 5. Others have given a similar rather low ratio of abortions to confinements. I do not feel however, as already stated, that these figures based largely upon material coming to dispensaries and hospitals are a true index. In 1910, I made a tabulation of 600 women coming to the Washington University Dispensary in St. Louis for treatment in the gynecologic and medical clinics. These women gave a record of 870 full-term confinements as compared to 371 abortions, a ratio of one abortion to 2.3 confinements. The figures obtained by Macomber in Boston from the records of 250 married women showed 128 abortions to 440 confinements, a ratio of 1 to 3.4. He also found that in patients with a lowered fertility, a group of 250 such women showed 85 abortions to 183 pregnancies, a ratio of 1 to 2.1. In England, Whitehouse of Birmingham gives the ratio of abortions to pregnancies as 1 to 5.9. More complete data are available from Germany where the ratio given by Schottelius in Hamburg for 1919 was 8,707 abortions to 16,779 confinements, or a ratio of 1 to 2. Heynemann is convinced that the ratio of abortions to confinements has steadily increased until at the present time the number of abortions equals those of full-term confinements. Latzko in Vienna has found a similar marked increase in the percentage of abortions as shown in Table II.

TABLE II. RATIO OF CONFINEMENTS TO ABORTIONS (VIENNA)

YEAR	CONFINEMENTS	ABORTIONS	PER CENT OF ABORTIONS
1898	1148	218	18.9
1908	1894	613	32.7
1913	3611	2,068	57.2

From Poland the figures are not quite so high. In the town of Warsaw there were in 1921, 3,403 confinements and 1,138 abortions, a proportion of 3 to 1. France, that has always had a very low birth rate, is reported by Balthazard, Lacassagne and Deleris to have an average of 500,000 to 600,000 abortions every year, making a proportion of practically 1 abortion to 1 confinement. According to Mme. Lebediva, the average in the small towns of Russia is about 1 abortion to 4 confinements but in the large cities such as Moscow it is 70 abortions to 100 confinements and in Leningrad, in 1928, there were recorded 38,500 confinements at term and 53,000 registered abortions or a ratio of 1 abortion to 0.7 confinements.

Relation to Marriage.—The increase in the number of abortions which has been generally observed throughout the world has been due less to a laxity of morals than to underlying economic conditions. This is seen by the fact that the considerable majority of even the criminal abortions occur in married rather than unmarried women. Among younger individuals, however, this is not the case. Thus Ofderdinger in Hamburg found that the percentage of illegitimacy among women under twenty years of age was 63 per cent; between twenty and twenty-five years, 40 per cent; between twenty-five and thirty years, 14.3 per cent; between thirty-one and thirty-five years, 3.5 per cent; and between thirty-six and forty years, 1.6 per cent. Riechelt found, in Breslau that abortions were more frequent among the unmarried, 1,179 of the patients being unmarried and 691 married. Dame Louise McIlroy in a report submitted July, 1929, states that in England criminal abortion before the war had been mainly resorted to by unmarried women but that at the present time it was most frequent among married women. In the United States, based on the maternal mortality statistics, of the 1,824 women who died following abortions 186 were unmarried whereas 1,638 women were married.

Relation to Age and Multiparity.—The reports from the maternal mortality figures of the Bureau of Child Welfare show that abortion preceded the death of 409 primiparae, equivalent to *18 per cent* of the 2,334 known primiparae whose deaths were included in the study, and that 1,170 multiparae or *26 per cent* of the 4,519 known multiparae died following abortion. In Russia, where legalized induced abortion is discouraged among primiparae, Genss has found that only 3.2 per cent occur below twenty years of age. In the larger towns the majority were in women between twenty and thirty years of age with one or two children, and in the country districts the period of greatest frequency of abortion was in women between thirty and forty years of age with three or four children. Somewhat in contrast to these figures are those given by Kardobovsky who found that among 2,656 legal abortions in Lugansk the average number of living children was only 1.7.. Roesle in his careful statistical study from Magde-

burg gives us the following interesting table showing the relation of legitimate and illegitimate abortions to the number of pregnancies.

TABLE III A. DISTRIBUTION OF LEGITIMATE ABORTIONS TO PREGNANCIES

TIME & PLACE	NO. OF ABORTIONS	POSITION OF THIS ABORTION TO PREVIOUS PREGNANCIES PER THOUSAND ABORTIONS			
		GRAVIDA 1	GRAVIDA 2	GRAVIDA 3	4 OR MORE
Magdeburg 1925-1927	3359	9.0	22.0	25.4	43.6
Halle a.s. 1919-1923	3015	11.8	22.7	20.7	44.8
Lubeck 1925-1926	606	6.9	21.1	27.6	44.4
Leningrad 1925	9976	4.2	17.4	19.8	58.6

TABLE III B. DISTRIBUTION OF ILLEGITIMATE ABORTIONS TO PREGNANCIES

TIME & PLACE	NO. OF ABORTIONS	POSITION OF THIS ABORTION TO PREVIOUS PREGNANCIES PER THOUSAND ABORTIONS			
		GRAVIDA 1	GRAVIDA 2	GRAVIDA 3	4 OR MORE
Magdeburg 1925-1927	1559	65.2	22.9	8.0	3.9
Halle a.s. 1919-1923	892	74.0	17.3	5.1	3.6
Lubeck 1925-1926	220	74.1	15.5	4.5	5.9
Leningrad 1925	3162	29.0	24.6	16.3	30.1

From these tables it would appear that legitimate abortions occur much more frequently among multigravidae, whereas among the illegitimate abortions in the smaller German cities about three-fourths occur in primiparae. Russia alone shows over 70 per cent of legal abortions among multigravidae. We have also a very interesting tabulation given by Genss showing the distribution of abortions and births to the age of the mothers in the city of Moscow in 1926.

TABLE IV. RELATION OF ABORTION TO AGE OF MOTHERS (MOSCOW)

AGE	NO. OF WOMEN	ALL BIRTHS	ABORTIONS	PER THOUSAND WOMEN			PER CENT OF ABORTIONS TO TOTAL PREGNANCIES
				BIRTHS	ABORT.	CONCEP.	
15-19	102,809	2,593	1,151	25.2	11.2	36.4	30.8
20-29	212,314	39,611	20,216	145.4	74.3	219.7	30.8
30-39	182,675	14,622	9,436	80.0	51.7	131.7	39.2
40-49	104,992	1,568	1,183	13.9	12.2	26.1	46.3
Totals	602,790	58,384	31,986				35.3

Relation to Duration of Pregnancy.—Since abortion increases in its dangers as the pregnancy advances and since spontaneous abortion is more frequent in the second and third month owing to the fact that the ovum is not yet so firmly attached to the uterus, it is not surprising that the incidence of all abortions is very much greater during

these two months. This difference has been emphasized in Russia by the refusal of the government to tolerate the induction of abortion after the third month except under very rare conditions. Genss gives the following interesting figures.

TABLE V. RATIO OF ABORTION TO PERIOD OF GESTATION (RUSSIA)

	FIRST MONTH PER CENT	SECOND MONTH PER CENT	THIRD MONTH PER CENT	FOURTH MONTH PER CENT	AFTER FOURTH PER CENT
1912 Secret illegal	0.45	41.5	33.0	14.3	10.4
1926 Illegal	1.1	57.1	28.9	8.1	4.8
1926 Legal	1.3	86.2	12.0	0.3	0.2

In Roesle's statistics from Magdeburg there was no appreciable difference between the spontaneous and criminal abortions. They are given as 0.4 per cent in the first month; 8.2 per cent second month, 33.6 per cent third month, 31.4 per cent fourth month, 15.9 per cent fifth month, and 7.2 per cent sixth month.

Relation to Urban and Rural Groups.—The striking difference in the abortion rates between large cities, towns, and country districts has already been touched upon. In the United States as far as our information goes there is a definite increase in the number of abortions in the large metropolitan centers, whereas at least the one report by Dr. Plass from rural districts in the midwest indicates that no noticeable increase has occurred in this area. These figures were obtained from 81 physicians, of whom 26 stated that there was an increase in abortions, and 55 stated that there was no such increase. Unfortunately the question was so worded that we cannot tell how many of the latter group believed that there had been a decrease. The proportion of abortions to confinements given by those 81 physicians averaged 18.3 per cent or approximately one abortion to five confinements. The ratio of spontaneous, therapeutic and criminal abortions has already been given. There seems to be a definite difference in the rural and urban groups as to the factors justifying the abortion. Genss found that in Russia illness was a much more common cause of legalized abortion in the country districts than in towns, 29.7 per cent compared with 19.3 per cent and that in the country districts the desire to conceal the pregnancy was far greater (7.3 per cent compared to 1.6 per cent in the cities). The figures given in the League of Nations report show that in the Soviet Union the registration of abortions is less complete in country districts and secret abortion far more common. In eight provinces of Russia the number of legalized abortions per 1,000 women showed this striking difference.

TABLE VI. RELATION OF ABORTION TO AGE IN URBAN AND RURAL DISTRICTS (RUSSIA)

		AVERAGE OF ABORTIONS PER 1000 WOMEN					
		UNDER 17 YR.	FROM 18-19 YR.	FROM 20-29 YR.	FROM 30-39 YR.	FROM 40-49 YR.	TOTAL AV. 15-49 YR.
In eight provinces	Rural districts	0.11	1.16	4.73	5.54	1.84	3.38
	Urban districts	0.92	11.69	48.35	40.41	10.19	35.40

In Germany also, as indicated by the puerperal mortality figures, we find that the incidence of abortion as indicated by the abortion mortality had a ratio of 2.1 per 1,000 in the towns and 0.78 per 1,000 in the country districts.

(To be completed in the December issue.)

Knoche: The Formation of Stratified Epithelium in Castrated White Mice after Injection with Sea Water. Zentralbl. f. Gynäk. **54:** 849, 1930.

Beginning with the observation that the natives of Chile assigned an aprodisiac power to a sea squirt, "Piure," the author, in a series of 15 well controlled experiments, injected extracts of this animal, and sea water, filtered, sterilized, or untreated, into castrated female mice. He found that all of these test solutions produced some epithelial cell formation in the mice in from twenty-four to thirty-six hours. The results were perhaps not as marked as are the results from follicuIin, but were definite. Distilled water, tap water, and artificial sea water gave no result. Only when the artificial sea water had sodium iodide added to it did any of the test animals react to anything other than natural sea water, or extract of sea squirt.

WILLIAM F. MENGERT.

Bickenbach: Alkali Necrosis of the Uterus and the Adnexa after Injection of a Soap Solution into the Uterus. Med. Klin. **26:** 1663, 1930.

The author reports the case of a woman who when three months pregnant had injected into her uterus a soap solution. Symptoms of peritonitis followed and a laparotomy was performed. At operation, in addition to peritonitis, it was found that all the pelvic organs were necrotic. The patient died soon after the operation. The soap solution which had been injected into the uterus, was forced through the tubes into the peritoneal cavity. All along its path hemorrhage and necrosis resulted. These pathologic changes were due not to the soap itself but to the alkali hydroxide which was in the soap mixture.

J. P. GREENHILL.

RECONSTRUCTION OF THE URETHRA AND VESICAL SPHINCTER BY EMPLOYING THE LEVATOR ANI MUSCLES*

By Marion Douglass, M.D., F.A.C.S., Cleveland, Ohio

(From the Department of Obstetrics and Gynecology, Western Reserve University School of Medicine and The Lakeside Hospital)

I WISH to present a method of operation used in 3 cases of urinary incontinence due to loss or destruction of the urethra and vesical sphincter. The levator muscles were employed in the construction of a vesical sphincter mechanism producing a satisfactory anatomical and functional result. Several years ago Dr. W. H. McGaw and I reported a successful case in which we attempted to reconstruct the urethra and vesical sphincter by making a loop of pieces of levator muscle, and encircling the urethra previously elongated by a flap transplantation performed previously. Since that time we have operated upon two similar cases by the same method with success. The repair or replacement of the urethra and the creation of a functionating sphincter mechanism is often most difficult but the cure of urinary incontinence is well worth almost any effort. No patient, perhaps, is more grateful for relief than the victim of urinary leakage.

Lamballe in 1849 discussed the causes and treatment of defects in the urethra. Baker Brown (1863) made a urethra by producing a punctured wound with a trocar below the clitoris into the bladder. Into this opening he placed a silver catheter and eventually, after healing, the patient was continent. This was the first cure. Lawson Tait (1878) made the first autoplastic repair of defects of the urethra followed by Schroeder and later, Freund (1880) and Pozzi (1888). Kelly elaborated the idea of the tunnel in the mucosa of the anterior vaginal wall. He dissected an elongated tongue of mucosa from behind the fistula and pulled it forward over the fistulous opening, making a tunnel and a new urinary canal. The anterior half was epithelialized. In most of the early procedures, an abnormally long urethra, detached from the bladder, has been made at the first step, and which was joined to the vesical neck at the second sitting with no attempt to produce a cut-off valve with varying tone.

When continence was obtained, it was probably due to the extraordinary length of the new urethra with a kink or some incidental narrowing of its lumen which offered a barrier to the escape of urine. Noble, Sellheim, Pèan, and others successfully reconstructed the urethra by transplantation of flaps. They employed the labia and vaginal wall while Rosser and Richards employed free transplantation of the fallopian tube and vermiform appendix and secured functionating urethras. The construction of an effective artificial sphincter is rather difficult. There have been various muscle transplantation operations attempted. Recently Deming transplanted a strip of gracilis muscle and brought the urethra through a loop made like

*Read at the Forty-sixth Annual Meeting of the American Gynecological Society, Hot Springs, Va., May 18-20, 1931.

a raquet at the end of the muscle, which supplied the urinary canal with a support which had sufficient tonus to prevent leakage of urine.

Taussig (1918) employed a unilateral transplantation of the levator muscle for incontinence with a partially successful result and recommended the employment of a muscle flap from both levators crossed under the urethra. Originally when this operation was done by us, we were unaware that the levator ani muscle had been previously employed in women in the attempt to make a sphincter. Ruebsam and Brjosowsky employed the pyramidalis and levator ani muscles successfully in men in 1923. There have been numerous procedures reported by French and German surgeons since we reported our first case by this technic. Imbert in 1924 reported an attempt to reverse pieces of levator ani muscle crossing over the anterior vaginal

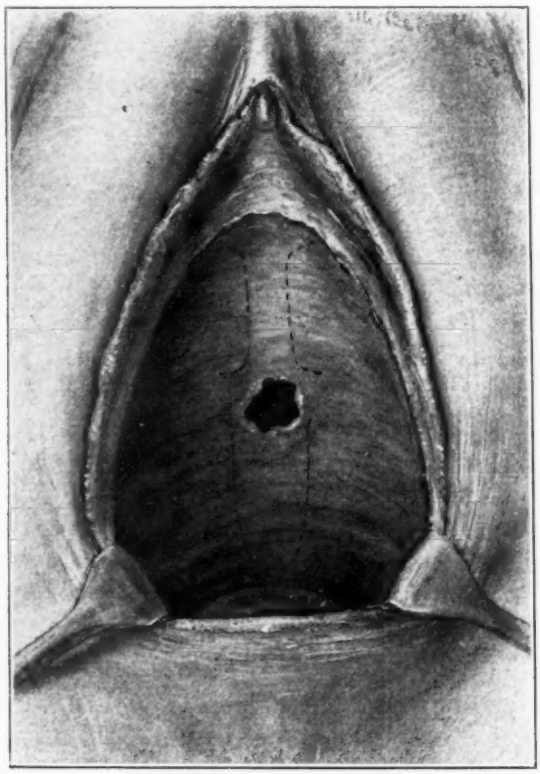

Fig. 1.—The fistulous opening in the anterior vaginal wall. Outline of the denudation.

wall under the urethra to make a bulwark but making no attempt to surround the urethra with any form of circular sphincter mechanism. Marion employed a free graft of vaginal mucosa made into a tube and carried in through a cystotomy wound, so as to lie in a trocar coming from the bladder to the exterior under the symphysis. Markoff employed a technic somewhat like a Witzel operation on the stomach, pulling out a long neck of bladder with a sharp kink above the urethral orifice. Other structures, such as strips of fascia from the rectus (H. Hans), have been placed beneath the urethra in loops. Martius in 1929 constructed a tube of vaginal mucosa as a urethra and placed across it a strip of bulbo- and ischio-caverosus muscle at its base, reporting a perfectly satisfactory functional result.

It would seem, from the diversity of methods, claimed in various hands to be satisfactory, that either the condition is extremely easy to cure and that a cut-off mechanism which is functionally satisfactory can be made by almost any method, or that the cure of vesical sphincter defects is extremely difficult and that there is no reasonably satisfactory method as yet described. Healing of almost any bladder defect with successful functional result may occur in any isolated instance regardless of the method employed. Having obtained a good

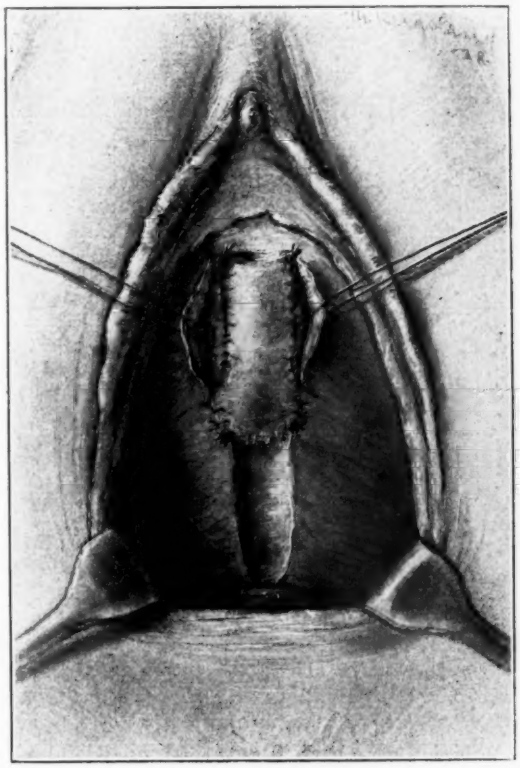

Fig. 2.—Mobilized strip of mucosa turned anteriorly and sutured to anterior flap covering fistula and producing a completely epithelialized tube.

result in 3 rather bad cases by a uniform technic, we felt that the method might merit consideration.

We attempted first a repair of the urethra so that there would be some urethra distal to the transplanted levators which were to act as the sphincter mechanism. In the final result, however, the increase in length of the urethra is more apparent than real because more than half of the transplanted flaps was lost by slough. In Case 2 however, where there was a gaping opening, the lower segment of mucosa was simply slid forward on the anterior segment and fastened with lateral

sutures, the mucosal edges being freshened. The second step was performed identically. It was necessary in Case 2 to place a few additional stitches laterally, to make the urethral orifice a trifle smaller.

The operation was done as follows:

The vesical neck is narrowed by fine sutures, plicating the vesical orifice which is superficially denuded. Incision is made along the lines indicated, mobilizing a flap of mucosa below the gaping fistulous opening, and incision of the mucosa is made above the defect as indicated in Fig. 1.

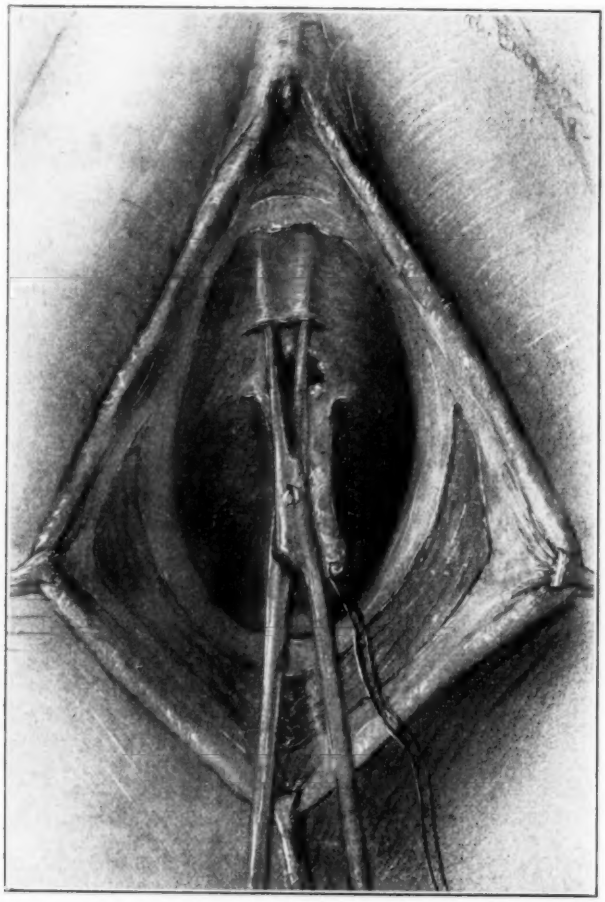

Fig. 3.—A flap is mobilized as before behind the opening of the urethra, and a tunnel dissected to a point *higher* than the normal urethral orifice.

This flap is turned and its lateral edges sutured with fine catgut sutures to the edges of the partially undercut flap above as in Fig. 2.

A small mushroom catheter is placed in the bladder and the vaginal mucosa is undercut sufficiently to permit suturing over a catheter placed in the new canal as in Fig. 3.

The catheter is removed after eleven or twelve days and the patient is discharged a few days later. These patients have to void every ten to twenty minutes

to prevent leakage. About two weeks later the patient is readmitted to the hospital. In the meantime some degree of continence has been attained if the bladder is emptied frequently. On examination it is found that the patient's urethra is approximately ½ inch long, and the urethral orifice is higher upon the vaginal wall.

At the second operation, a flap of mucosa is dissected free posterior to the urethral orifice as in step 1 and a tunnel under the mucosa produced above the urethra as in Fig. 4.

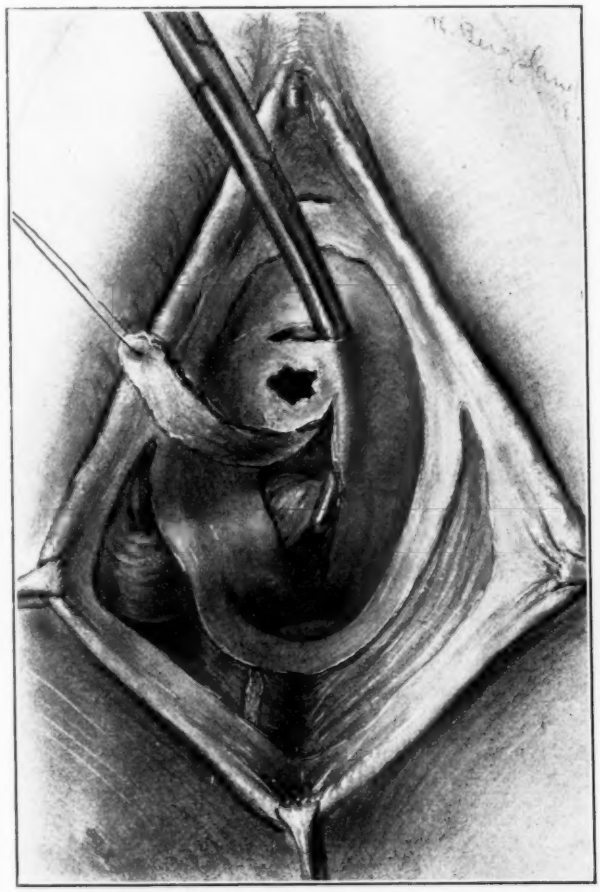

Fig. 4.—Perforation made across roof of vaginal canal to grasp opposite levator edge which has been exposed and cut off.

The perineum is denuded and strips of levator muscle are cut free and picked up by a Kelly clamp which is passed across the roof of the vagina under the mucosa. The freed flaps of muscle are pulled across the roof of the vagina and around the urethra as in Fig. 5, each flap passing to the opposite side.

This is a little difficult but with patience can be done without tearing the mucosa or producing bleeding. The crossed ends of the muscles are fastened together above and below the urethra with fine stitches as in Fig. 6.

This forms a complete ring of muscular tissue. A small mushroom catheter is

inserted at this point through the tunnel and through the muscular circle produced by the levator transplantation as in Fig. 7.

The flap of mucosa was pulled through the tunnel to form the anterior inner surface of the new urethra as in Fig. 8.

A few stitches are taken at the angles near the neck of the bladder to repair the two small lateral defects which is the weak spot in the urethral repair. This, however, is external to the new sphincter and is not so important. The denuded portion is closed with continuous chromic catgut sutures, and near the sphincter the

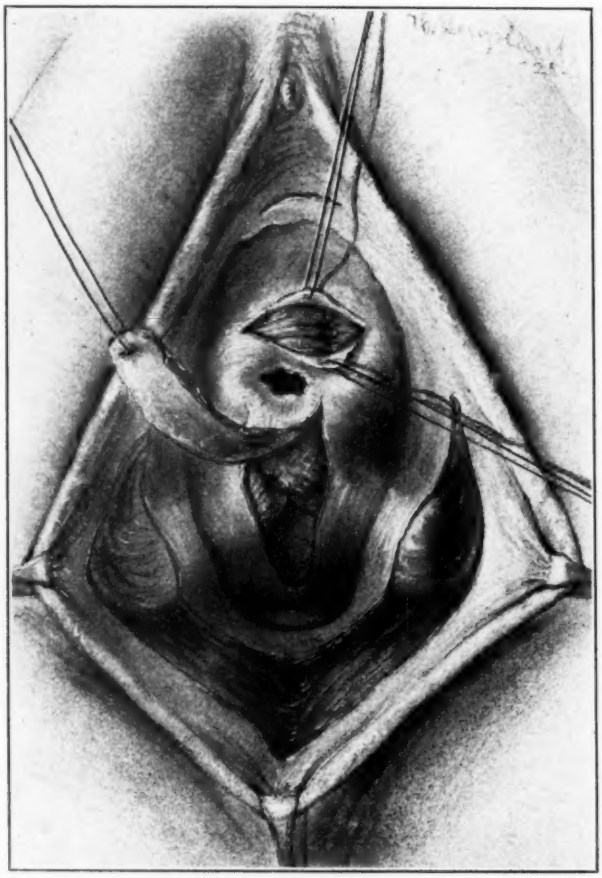

Fig. 5.—Suture of the levator muscle transplants around the end (i. e., at the present orifice) of the urethra, forming a circle of muscle preliminary to lengthening the urethra.

mucosa is dissected back laterally to permit its mobilization and it is everted by means of fine buried mattress sutures to form a small bulkhead over the lateral defects at the edges of the new urethra. The perineum is closed, approximating the levators as well as possible but taking care not to produce too much narrowing of the vaginal orifice. The vagina may be sutured transversely, so as not to produce vaginal atresia. The transplanted levator ani muscles can be felt lying in the upper lateral walls of the vagina. The vagina is definitely narrowed, the point of greatest narrowing being at the neck of the bladder about 1½ inches from the outlet. The urinary stream is diverted into the new canal.

CASE REPORTS

CASE 1.—Mrs. R., colored, aged thirty, para 5. This patient had been partially incontinent since her last pregnancy five years ago and had marked frequency with complete incontinence for the last year. The baby had been large and there has been dystocia but no instrumental delivery. The Wassermann was negative. Pelvic examination revealed a relaxed vaginal outlet with cystocele and rectocele. The urethra had been torn away and the situation of the present urethral orifice was almost exactly at the neck of the bladder. The opening admitted a little finger

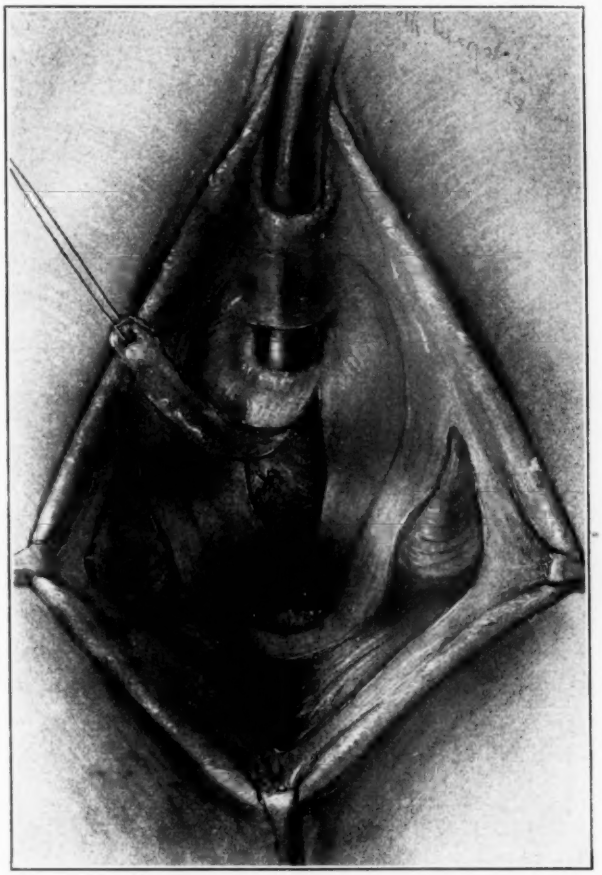

FIG. 6.—Insertion of retention catheter through the new sphincter.

which could be passed through the neck of the bladder. There was a polypoid ectropion of vesical mucosa in the form of a papillary growth which acted almost as a ball valve. The cervix was in good condition. The uterus was anterior, enlarged to three or four times its normal size by multiple myomas, one of which on the anterior surface encroached upon the bladder. The uterus was freely movable, and there were no lateral masses. It was decided merely to attempt the reconstruction of the urethra and bladder sphincter, and then perform hysterectomy and perineorrhaphy later. There was considerable scar tissue in the vaginal vault which made the denudation somewhat difficult. The above described procedure was carried out in two stages about one month apart.

Immediate convalescence was uncomplicated. The catheter was removed on the twelfth postoperative day and the patient was completely incontinent. She had a chill the following day, with headache, malaise and leucocytosis. The urine showed a few pus cells. The temperature returned to normal in three or four days. Careful investigation of the urine, pelvis, and lungs failed to reveal the source of the chill. The catheter was reinserted without difficulty and there was no leakage. The catheter was removed fifteen days later, and the patient had fair voluntary control of urination. Occasionally the urine escaped without her knowledge, but by emptying the bladder fairly frequently she was able to maintain a fair degree of

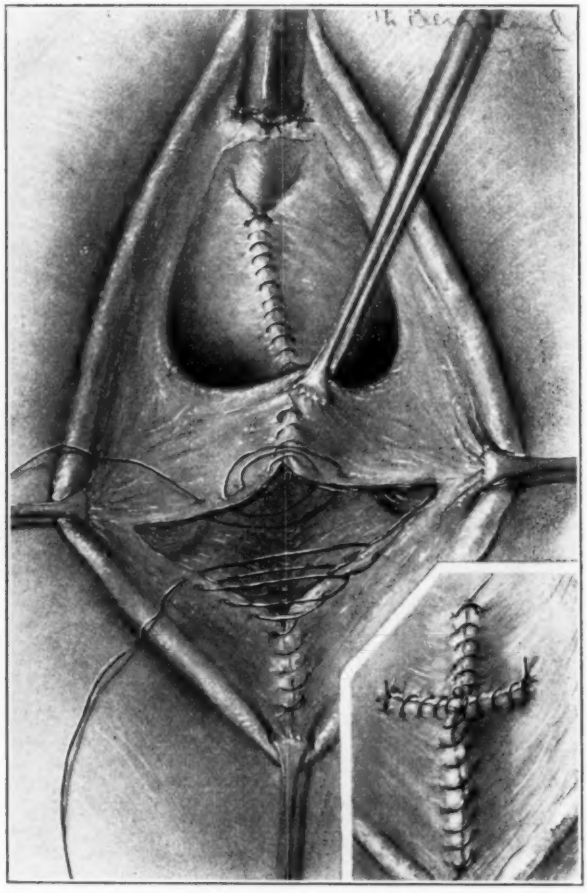

Fig. 7.—Suture of the submucosal fascia and vaginal mucosa is complete and the closure of the mucosa of the posterior vaginal wall is being completed in a T-shape to avoid tension.

continence at the time of her discharge from the hospital. This patient became completely continent of urine within a few weeks.

CASE 2.—C. G., colored, para 1, aged twenty-five. This patient came into the hospital complaining of frequency of urination. Her past and family histories were negative. Catamenia was normal. Pelvic examination was normal except for slight tenderness in the adnexal region. Projecting from the vaginal orifice was a red urethral caruncle about 1½ cm. in diameter. This was removed by dissection and the patient was discharged relieved of urinary symptoms in about five days.

Three weeks later, on pelvic examination, it was seen that the urethra had been the seat of some destructive process and one could look directly into the bladder. The urine contained some albumin and a few pus cells. Biopsy from the neck of the bladder showed benign papillary epithelial overgrowth. A plastic was performed on the neck of the bladder. A mushroom catheter was placed in the bladder and this case was treated like the other one.

This patient returned to the hospital in a month completely incontinent. The urethra was about 1 to 2 cm. long. The second step was performed transplanting the levators. The patient was kept in the hospital a month and could retain urine without leakage for an hour. She was discharged continent providing the bladder was not overfilled. The patient has been six months under observation. I have twice narrowed the vesical orifice further by fine chromic sutures. This was done because the patient was incontinent only when the motion was made of rising from the chair. On her feet, walking, sitting, or lying down, her bladder is competent.

CASE 3.—G. P., colored. This patient is a multipara of forty-two years. Physical examination revealed a rectovaginal fistula and stricture of the rectum. This patient was a known syphilitic, inactive following intensive treatment. She complained of urinary incontinence. There was a granulating area about 3 cm. in diameter below the urethral orifice. The urethral orifice was dilated so that the tip of the finger could be inserted into the bladder. Investigation of this patient showed no sign of central nervous system syphilis although the patient was known to have a 4-plus Wassermann. Operation was performed upon this patient with good result. The stricture was dilated and the rectovaginal fistula closed. A preliminary colostomy was done. The above described operation was performed on the bladder after stricture was dilated and the rectovaginal fistula closed. The patient is in excellent health and spirits. She is continent within the limits of emptying her bladder every hour.

SUMMARY

These patients have been followed for periods ranging from six months to four years, and we find that they are completely continent except for the very occasional loss of a few drops of urine. They do not find it necessary to wear pads. Firm pressure in the midpoint of the vaginal floor opens the urethra permitting the escape of urine. The attachment of each sphincter end across under the urethra to the opposite side of the vaginal roof gives a constriction of the urethra by scissor-like mechanism of fibromuscular tissue. The method may be useful if any similar cases are encountered. We believe it would be advisable not to suture the perineal muscles too tightly following transplantation, as any pull on the perineal floor seems to pull down on the urethral floor which favors leakage. Two of our patients are able to produce visible voluntary contractions of the synthetic sphincter. We believe that transplantation of the levator muscles may be used with profit in the repair of certain vesical sphincter defects in the female.

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(For discussion, see page 788.)

THE RESPONSIBILITY OF THE MEDICAL PROFESSION IN THE MORTALITY FROM CHILDBEARING*

By George W. Kosmak, M.D., New York, N. Y.

SO MUCH has been spoken and written in recent years about the high mortality from childbearing in the United States that one hesitates to bring up the subject again before a group of this kind. Yet there are certain responsibilities which an organization of specialists should bear and which I may, or may not, be successful in defining. However I will venture the assumption in presenting this topic that it may be possible for a society which has an inherent interest in obstetrics to acknowledge a certain responsibility in an endeavor to better certain apparent shortcomings in this branch of medical practice. For somewhere there must reside a cause, or causes, for the undeniably high maternal death which characterizes childbearing in this country. It is high as compared with the mortality in other diseases and it is high as compared with that of many other countries.

The mortality rates of any particular group of diseases are high or low only in comparison with those of an earlier period or those that are current elsewhere at the present time. It is difficult to set a standard, for conditions vary in different countries and the basis for collecting statistics is subjected to equal variations. It has long been a favorite expression to state that the United States is nearly at the bottom of the list of civilized countries with respect to its puerperal mortality rate. Such invidious comparisons have served well in several widely spread publicity campaigns but in reality they can be dismissed in many instances when subjected to a keener analysis. Of what value is it, for example, to compare the United States with a nation like Chile, in which the gathering of vital statistics must be limited to a very small portion of the country. Or, on the other hand, with a closely knitted, homogeneous population like that of Holland,

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or Sweden, or Norway, in which the total number of people scarcely equals that of some of the more populous states or cities of this country. Be it remembered on the other hand that there are other countries of a high degree of civilization with mortality rates equally high. I believe such comparisons are of little scientific value, but aside from this we must admit that the mortality rates in this country are high if we compare them merely with those of other medical and surgical illnesses.

In view of the current propaganda in our own country, attention may be called to the fact that other nations are likewise deeply concerned about the high mortality incident to childbirth. The English Ministry of Health published only last year an extended report by a special investigating committee of which Sir George Newman was the Chairman. The puerperal death rate in England and Wales between 1911 and 1929 rose from 4 per 1,000 live births to 4.3. Admitting the very complex nature of the problem, the Commission believed that a general tightening up and strengthening was needed of each link in the chain of obstetric supervisions rather than any single, arresting or comprehensive remedy. Moreover the Commission concluded that an excessive puerperal mortality is largely preventable. It will be of interest to note the effect of the new midwife teaching and practice on the British rates. Belgium with a puerperal death rate of 5.5 per 1,000, Germany with 5.1, and other nations are similarly interested, although these rates are all apparently less than ours of about 6 per cent. As declared by Dr. Parran, the Commissioner of Health of New York State, in a recent address, the community, the state, or the nation which is not taking active steps to safeguard the health of its mothers is shirking one of the most important problems in the whole field of public health.

Is it possible to determine the reason or reasons for this apparent lack of improvement in obstetric practice as compared with other departments of medicine? It has been claimed among other things that a reduction in home confinements would bring about an improvement. During the last two or three decades, obstetric practice in the United States has been largely influenced by the hospitalization of an increasing number of pregnant women and yet practically no reduction in mortality rates has resulted. For example, in puerperal sepsis the rate has remained about the same for twenty years and it is undeniably high.

In the City of New York 122,811 births took place in 1930, of which 81,576 occurred in institutions. Midwives and "others" confined 12,109 women and these, with the "home" cases of physicians totalled 41,235. In other words, practically two-thirds of the deliveries in New York City took place in hospitals. And with what result?

Among the 122,811 births of over twenty-eight weeks there were 672 deaths of the mothers, or approximately 1 in every 183 cases, or 5.4 per cent. Almost one-third of the deaths were due to sepsis (32.5 per cent), 18.2 per cent to accidents of labor, and 16.4 per cent to toxemia, 12.9 per cent to hemorrhage, with scattering percentages of the remainder. Naturally it would be unfair to judge the deaths in the home deliveries compared with those in hospitals, because many more serious cases were in the latter. However if we evaluate the preventability of the cases whether in the home or in the hospital, and this has been attempted, about 67 per cent of the fatal cases might be designated as preventable.

The increased hospitalization of obstetric patients has resulted in another change, namely, an increased operative interference in deliveries, frequently of a major character, and it is nothing unusual at the present day to find institutions with an operative incidence of over 30 per cent among their maternity patients. What result can this have on the practice of obstetrics in general? Is it not fair to assume that the effect is a deleterious one? A careful analysis of certain studies on the subject that have been made and are being made in this country would seem to indicate that perhaps here we may have one explanation of our high maternal mortality.

I would venture to call attention at this point to these studies in greater detail. Among the most noteworthy and recent is that made by Drs. Adair, Mussey and Holmes[1] based on the investigation of over 2,500 puerperal deaths occurring during 1927, in 12 states of this country, well distributed geographically. It was found that septicemia accounted for 41 per cent, toxemia 23 per cent, puerperal hemorrhage 11 per cent, accidents of pregnancy and labor 18 per cent of the total. It is of interest to note that in almost 1,700 patients an operative procedure was done; about 12 per cent of these were forceps deliveries, 9 per cent cesarean sections and about 5 per cent podalic versions. Among the cesarean cases the causes of death as listed were toxemia in 38 per cent, the operation itself in 25 per cent, sepsis in 25 per cent, and hemorrhage in 10 per cent.

In a very complete study made by DePorte[2] of the Department of Health of the maternal mortality of New York State, between the years 1915 and 1925, the mortality rate was 58.5 per 10,000 total births; in other words, 1 in every 171 births resulted in the death of the mother. Diseases of the puerperal state were found to be second in order of importance among the causes of death of women between the ages of fifteen and forty-four, with 1 out of 9 deaths. The first place was held by tuberculosis, heart disease was third, and cancer fourth. Among married women from fifteen to forty-four years of age, puerperal causes were responsible for 1 in 5 deaths. A comparison of the rates in the first half with the second half of the decade

shows that the mortality from puerperal sepsis declined about 4 per cent, while that from toxemia in general was reduced 14 per cent, but the mortality from hemorrhage increased 14 per cent.

One of the most illuminating studies on this subject is the report made by E. D. Plass,[3] of the State University of Iowa, to the recent White House Conference, in which the relation of forceps and cesarean section to maternal and infant morbidity and mortality is very carefully considered. He presents certain unpublished statistics of the Children's Bureau covering the maternal deaths in 13 states for 1927 and 15 states for 1928, which show that among 4,839 cases in which data are available, 2,225 patients, or 46 per cent, died after an operation done at delivery, 16.5 per cent following forceps, and 11 per cent cesarean section. There was also a high percentage of toxemia deaths in the operative groups. A questionnaire directed to 217 representative general hospitals which reported 120,999 deliveries during 1929 disclosed a forceps incidence of 17.9 per cent. Sixteen special obstetric hospitals reported over 24,000 deliveries with a forceps incidence of about 20 per cent. It is not possible to present any comparative figures, so that estimates as to the possible increase of forceps operations are not available except in a few instances, such as that of the Hartford General Hospital. In this institution we find, for example, that from 1916 to 1928 the forceps incidence increased from about 7 per cent to 16 per cent, although the number of deliveries was only increased from 985 to 1,507. Comparing these figures with foreign clinics, Plass found that the average of four very prominent European institutions was a little over 3 per cent. Of course in evaluating our American institutions the prevalence of the so-called prophylactic forceps operation must be borne in mind. This is rarely done abroad.

Plass takes up next the question of cesarean section and finds a cesarean incidence of 2.9 per cent in 119 hospitals in the United States which responded to his questionnaire. The ratio varied among these hospitals from a fraction of 1 per cent to over 14 per cent. Comparative studies also show that a decided increase in the number of sections was noted in a fifteen-year period. It is interesting to compare these high rates with those in foreign countries where the percentage varied from 0.6 per cent in Scandinavia to 3.9 per cent in Germany. The high percentages in certain German clinics are very adversely criticized by other leading obstetricians in that country.

Finally I desire to draw attention to another careful study of this kind which is now being conducted in New York City by a joint committee from the New York Obstetrical Society and the Academy of Medicine. In this a detailed analysis is being made of all deaths occurring during a three-year period, each case being subjected to a searching inquiry by a physician investigator within a week of the

occurrence so that the facts are still fresh in the minds of the doctor or midwife. Its extent and value must be evident from the fact that the city of New York alone averages over 120,000 births annually, of which about 80,000 occurred in institutions during the year 1930. During this same year there were 672 deaths in women over twenty-eight weeks pregnant, a rate of 5.4 per 1,000, about the same as that for the entire State. Unless some decided reductions occur in the succeeding two years, this would mean that over 2,000 women in New York City alone will die during this three-year period from puerperal causes as compared with 2,650 cases covered in the Holmes, Mussey and Adair compilation of 1927 which included 12 scattered states in the registration area. The study is not yet complete but the final report on the work of this committee will be awaited with interest and should constitute a practical basis for effective reforms if these are found necessary.

It is evident from the studies of puerperal mortality statistics made by competent observers, that among the fatal cases a considerable proportion gave a history of a previous operative delivery, usually about 50 per cent. Forceps, version, and cesarean section seem to constitute a trinity which must be viewed with trepidation and alarm if the published results are a criterion of its efficacy. Cesarean section at the moment seems to demand our special attention. No matter what arguments may be brought forward as to the safety or ease with which this operation can be done, it would appear from these perhaps limited statistics that a note of warning should be issued. Reports have shown that the incidence of cesarean section is high in many communities and it would seem opportune for this and similar societies to use their influence in curbing an operative instinct which contributes to a maternal mortality. The fault must be sought: either the indications for the operation have not been properly observed, the operative environment is defective, or the operator and his technic leave something to be desired. Cesarean sections by experts in leading institutions have been done in large series without a high mortality, and it is but natural to assume that if the operation is attended with a fatal outcome in so many cases, the operator or the environment must be at fault. Judging from the results obtained in New York City, cesarean section is evidently neither safe nor simple and should be reserved for those who know how to do it and who will honestly weigh the indications demanding this major procedure before attempting the same.

There are certain risks in childbearing which cannot be entirely eliminated, accidents in labor, hemorrhages, sudden unlooked for toxemias, intercurrent diseases, autogenous infections and perhaps a few others. But after making due allowances for these, there remains an uncomfortable feeling about a death rate from cesarean section

for example, which is much above that from purely surgical laparotomies, 5.7 per cent in a New York series in 1930 as compared with approximately 2 per cent in general surgical laparotomies, including we may assume an equal number of potentially bad risks. Does it mean that the obstetrician is a poor "laparotomist," if I may be allowed to use that term? If so, then a revision of our obstetric training is necessary, so that certain permissible limits may be established. Although this is a problem for the future, it is one that eventually must be faced and standards of competency recognized. A moderately satisfactory test of competency of an institution or an individual practicing obstetrics within its walls is the evaluation at stated intervals of the work done. This can be accomplished through the medium of staff conferences held every month as prescribed in the hospital standards promulgated by the American College of Surgeons. At such conferences every obstetric morbidity and mortality can be discussed and a comparison of the facts connected with the individual case should do much to explain or, if necessary, correct the handling of subsequent cases. Many institutions throughout the country have adopted this procedure and it should be extended to all. The scheme is not unusual or impractical and would be of mutual benefit. Of course, it cannot be applied to the individual practitioner of obstetrics nor in private hospitals or sanitaria in which there is no official staff or director. But even in the latter case the introduction of such a scheme of supervision would do much if honestly carried out to enhance the standing of the particular institution. In so far as home confinements are concerned, the individual practitioner is the only critic of his deeds. It is found, however, that comparatively few obstetric deaths result from ordinary home deliveries and that most of these are the result of, or accompanied by, operative intervention.

It is quite generally assumed that the wider acceptance of the principles of prenatal care has done much to reduce mortality from childbearing. This subject probably has been accorded greater attention in the United States than elsewhere and particularly during the last two decades it has constituted the chief feature in the nation-wide propaganda for better maternity care developed through the medium of various governmental and private social welfare activities. But notwithstanding the high degree which the system of supervising the pregnant woman has reached in the United States, and which is the envy of many obstetricians in foreign countries with which our own shortcomings are compared, little effect is apparent on our mortality statistics. It is true that the incidence of pregnancy toxemias has declined, but sepsis, hemorrhage and certain other perhaps preventable conditions claim about as many victims as before. There is but one lesson to be drawn from this; namely, that no matter how carefully the prenatal period may be supervised, what counts in the end

is the skill and knowledge with which the labor itself is conducted. Studies on obstetric mortality from various sources apparently confirm the assumption that unsatisfactory care during labor is the chief factor in producing our high maternal mortality.

The question remains, what can we do to change this state of affairs? Perhaps we have gone as far as we possibly can in the development of prenatal care standards, although it is quite evident that a certain proportion of pregnant women are either indifferent or ignorant of the necessity of such supervision. This lack of interest may perhaps be overcome by well directed effort, but at any rate, the blame cannot be cast entirely on the doctor. When we come to consider the results of the care during labor, little blame for the fatalities can be ascribed to the patient. It is difficult to evaluate the responsibility of the physician in labor but case studies such as those being made by the committee of the New York Academy of Medicine will undoubtedly furnish food for thought, in presenting an estimate at least of the preventable deaths.

Summing up in a general way the observations of widely scattered students of the subject, we might venture to claim that unsatisfactory care during labor depends on the following factors: (1) Lack of knowledge on the part of the public and ignorance in selecting an attendant for confinement. (2) Improper or insufficient education of the physician in the appreciation of the importance of proper technic in deliveries. (3) The desire to terminate labor rapidly by operative interference and to alleviate the so-called pangs of childbearing by indiscriminate narcosis and analgesia. (4) Improper use of hospital facilities, particularly those of a low grade. (5) Insufficient attention to methods of training the midwife and the development of satisfactory supervision over her work.

The mere statement of these conditions is of little value unless steps are taken to follow them up. In the discussion on his report at the recent White House Conference on prenatal and maternal care, the late John O. Polak stated in addressing this audience of specially interested persons, that the basic thing in the situation was whether we should put ourselves on record in favor of a nation-wide campaign for better obstetrics. The details of such a problem are secondary and must be handled by each locality to the best of its ability, but a nation-wide program can only be developed by interested organizations acting in unison. The White House Conference brought out quite clearly what the essentials of such a program should be. Firstly, it includes better medical education and training for the physician in obstetrics in the widest sense. Secondly, it means the improved training of nurses and midwives. A satisfactory and practical scheme of midwife education and supervision must eventually be organized, although professional sentiment in this country heretofore has been opposed to this

kind of extramural practitioner. Yet the results have been so good where the method has been given a trial, that the physician must learn to regard the question of midwife practice in a broader way. Thirdly, the program means the education of the patient and the doctor and the various governmental groups as to what can be accomplished by consecutive care of a pregnant woman in every stage of this process. The medical participation in all parts of this program is of paramount importance and as physicians we can contribute the most substantial aid in its development. The country has been aroused in recent years to the importance of the problem of better obstetric care and this agitation has culminated in the deliberations proceeding from the White House Conference. It is hoped that the permanent committee which is to be the outgrowth of this conference will seize upon the opportunity for a close affiliation with the professional groups which are directly concerned, so that a concerted effort may be made to improve a situation, the blame for which is being rapidly fastened on the doctor and from which he can only extricate himself by his own efforts.

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Gundel, M., and Oettingen, Kj.: Studies on the Bacterial Content of the Uterine Cavity in the Pregnant and the Non-pregnant Woman. Zentralbl. f. Gynäk. **54**: 327, 1930.

The uterine cavity of the nonpregnant individual, as determined in a series of uteri obtained at abdominal sections for various causes is sterile except in a few cases of submucous myomata. The uterine cavity of the pregnant woman, on the other hand, is not always free of bacteria. Using the ordinary bacteriologic technic, bacteria such as Doederleins, Diplostreptococcus, and in a single case, Staphylococcus albus, were found in about half of the cases. The primary seat of these organisms probably is the vagina. The amniotic fluid was always sterile, but bacteria were found in the membranes, decidua, and in uterine and cervical smears. The author has nothing to say concerning the mode of entrance of these bacteria, and does not believe that a prognosis as to the outcome of cesarean section can be made. None of this holds, however, after vaginal manipulation has introduced pathogenic bacteria into the vagina.

William F. Mengert.

THE NATURE OF URINARY PROTEIN IN ECLAMPSIA*

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THE ratio of albumin to globulin in the urine of patients suffering from nephritis appears to bear a somewhat constant relationship to the type and severity of the renal disease present. Thus, Hiller, McIntosh and Van Slyke[1] have found that it is usually above 10 in nephrosis, between 5 and 10 in acute nephritis, while in the advanced stages of chronic glomerular nephritis with urea retention and impaired kidney function, it falls below 5. They note, moreover, that cases of acute nephritis show a low ratio during the early stage followed by a higher one during recovery. In view of such facts, these authors attach a certain prognostic significance to the albumin:globulin ratio of the urine in nephritis and agree with the earlier students[2, 3] of the subject that in general the prognosis is grave in patients showing relatively high urinary globulin.

The nature of the urinary protein excreted in the various toxemias of pregnancy has apparently received little attention. The only approach that has been made to the problem, indeed, seems to be the study of Wallis[4] reported in 1921, although Dr. Williams tells me that Emerson and Slemons many years ago made some observations in this service, which were not published. Wallis applied certain refractometric and nephelometric tests to the urinary proteins in various conditions and reached the conclusion that in "toxic albuminuria," including eclampsia, the ratio of albumin to globulin was 2 to 1, while in nephritis it was 6 to 1. As the result of this study, he regards the urinary albumin:globulin ratio as a valuable means of differentiating preeclampsia from nephritis.

The present paper reports a quantitative study of the urinary albumin and globulin in 21 cases of toxemia of pregnancy. The group comprises 9 cases of eclampsia, 4 of preeclampsia, 6 of chronic nephritis, and 2 of nephrosis complicating pregnancy. In several instances the corresponding figures for the serum proteins were also determined.

METHODS

A freshly catheterized specimen of urine was first adjusted to a P_H just alkaline to phenol red. As shown by Hiller,[5] failure to carry out this adjustment may lead to gross error in the subsequent precipitation of globulin. Samples of the adjusted urine were then subjected to the following three procedures:

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1. A 5 c.c. portion was analyzed for total nitrogen by the Kjeldahl method. The resultant figure in grams, which we will call A, equals nonprotein nitrogen, plus albumin nitrogen, plus globulin nitrogen.

2. To a 10 c.c. portion an equal volume of 44 per cent sodium sulphate was added, thereby precipitating the globulin. After standing at 38° C. for two hours, the coagulated globulin was filtered off and Kjeldahl analysis applied to a 10 c.c. sample of the filtrate. The resultant figure in grams, which we will call B, equals nonprotein nitrogen, plus albumin nitrogen.

3. To another 10 c.c. portion an equal volume of 10 per cent trichloracetic acid was added, precipitating all the protein. After filtration, Kjeldahl analysis was carried out on a 10 c.c. sample of the filtrate. The resultant figure in grams, which we will call C, equals nonprotein nitrogen.

The calculation becomes then as follows:

$$(B - C) \times 6.25 \times 200 = \text{Albumin in grams per liter.}$$
$$(A - B) \times 6.25 \times 200 = \text{Globulin in grams per liter.}$$

All analyses were done in duplicate. In most instances, moreover, it was possible to examine several specimens of urine from the same patient so that our figures in reality represent averages over periods varying from a few hours to six months. The number of specimens examined in each case is listed in the last column of Table I.

The figures reported in this study are based entirely on the Kjeldahl procedure just described since we believe that the values it yields

TABLE I. SHOWING THE RELATIONSHIPS OF THE URINARY PROTEINS AND OF THE SERUM PROTEINS IN VARIOUS CONDITIONS COMPLICATING PREGNANCY

CASE NO.	DIAGNOSIS	SERUM PROTEINS			URINARY PROTEINS			NUMBER OF ESTIMATIONS
		ALBUMIN GM. PER 100 C.C.	GLOBULIN GM. PER 100 C.C.	A : G	ALBUMIN GM. PER LITER	GLOBULIN GM. PER LITER	A : G	
1	Nephrosis	1.0	3.0	0.3	5.8	0.4	*14.0*	9
2	Nephrosis	2.6	3.2	0.8	3.8	0.3	*12.6*	4
3	Nephritis	3.2	2.0	1.6	4.0	0.5	*8.0*	5
4	Nephritis				8.9	1.1	*8.0*	2
5	Nephritis				3.6	0.6	*6.0*	2
6	Nephritis	3.2	1.9	1.7	3.5	0.6	*5.9*	4
7	Nephritis (fatal)	2.9	2.0	1.4	16.0	3.6	*4.4*	3
8	Nephritis				7.6	1.0	*7.6*	2
9	Preeclampsia	3.1	2.3	1.3	4.0	1.0	*4.0*	3
10	Preeclampsia				7.1	2.8	*2.5*	2
11	Preeclampsia	3.4	2.7	1.3	3.7	1.4	*2.6*	2
12	Preeclampsia				5.3	1.8	*2.9*	1
13	Eclampsia	3.7	2.5	1.5	8.8	2.5	*3.5*	2
14	Eclampsia				9.2	4.0	*2.2*	1
15	Eclampsia	3.0	2.6	1.2	29.1	8.1	*3.6*	3
16	Eclampsia				7.1	2.9	*2.4*	2
17	Eclampsia				3.0	1.2	*2.5*	2
18	Eclampsia				6.8	2.6	*2.6*	3
19	Eclampsia				14.2	5.0	*2.8*	1
20	Eclampsia	2.8	2.0	1.4	16.7	5.5	*3.0*	2
21	Eclampsia				4.8	1.2	*4.0*	3

more nearly approximate the true ones than those given by any other method. It may be noted in passing, however, that in most cases we have made parallel determinations by the more rapid colorimetric

method of Hiller[5] and find that the albumin:globulin ratios thus obtained agree approximately with those given by Kjeldahl analysis. In our hands, however, the Hiller procedure has given higher absolute values for protein than the Kjeldahl.

The serum proteins were determined by a modification of the Greenburg method.[6]

RESULTS

The detailed results of the study are listed in Table I, while the average figures for the various conditions investigated are shown diagrammatically in Chart I. The outstanding finding of our study was the large amount of globulin present in the urine of eclamptic and preeclamptic patients. The urinary globulin in eclampsia, indeed, was found to comprise 26 per cent of the total protein present, and in preeclampsia 25 per cent. In nephritis, on the other hand, globulin con-

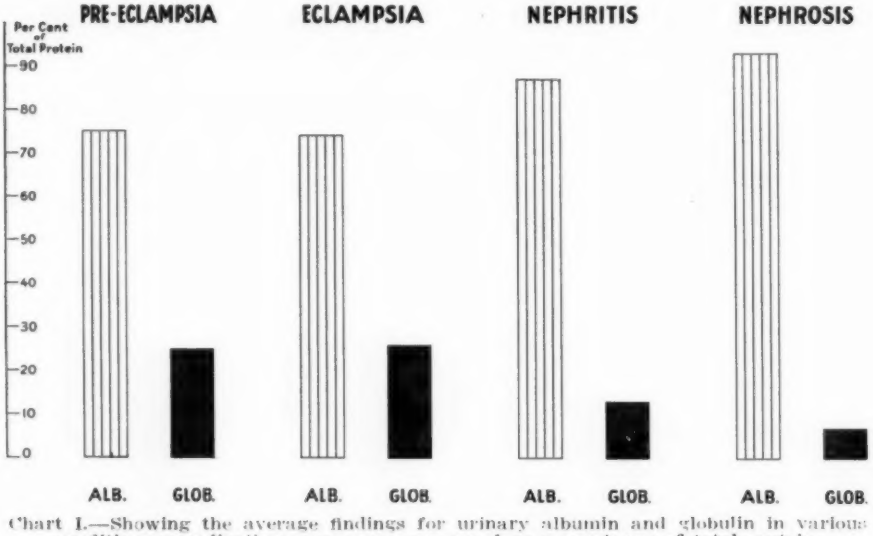

Chart I.—Showing the average findings for urinary albumin and globulin in various conditions complicating pregnancy, expressed as percentages of total protein.

stituted but 13 per cent of the urinary proteins and in nephrosis only 7 per cent (Chart I). Expressed in terms of the albumin:globulin ratio, the average ratio in eclampsia and preeclampsia was found to be 3, while in nephritis it approximated 7 and in nephrosis averaged about 13. It will be noted further that in all of the eclamptic and preeclamptic patients the ratio fell below 5, a level usually associated with the severest type of nephritis. In our group classified as nephritis the albumin:globulin ratio only once fell below 5 (Case 7); and this was an advanced case terminating in death shortly after admission.

The cases listed as nephrosis complicating pregnancy were apparently genuine types of the disease since they manifested normal blood pressure, marked proteinuria, edema, high blood cholesterol and the characteristic inversion of the serum protein ratios.

COMMENT

The phenomenon of proteinuria, according to our present conception, is localized in the renal glomerulus. If the capillaries composing this body are normal, the serum proteins, by reason of their large molecular size, are retained within these vessels; but if, on the other hand, the capillary walls have been injured, the serum proteins pass through them at once into the urine. While the injury is usually the result of disease processes, it may be produced experimentally by causing a temporary asphyxia of the vessel walls; thus, Nussbaum[7] has found that intermittent occlusion of the renal artery causes immediate proteinuria. Adrenalin given in sufficient doses to constrict the renal vessels also induces a transient proteinuria,[8] and in the cat the constriction caused by fright or by the inhalation of CO_2 may have the same effect. The glomerulus which permits proteinuria may accordingly be compared to a filter which through injury has become so porous as to allow even large particles to pass into the filtrate.

It follows as a necessary corollary to this conception of proteinuria that the serum albumin molecule, which is smaller than that of serum globulin, may be expected to pass more readily through an injured glomerulus and conversely that a proportionately greater degree of injury will be necessary to permit the passage of the large globulin molecule. The theoretical evidence, then, is in full accord with the clinical findings of Hiller, McIntosh and Van Slyke, and of other investigators in this field, and lends support to the view that urinary globulin, when present in large amounts, indicates a severe lesion of the glomerular capillaries. Accordingly, the present study, which shows that the urine of eclamptic patients contains a very high percentage of globulin, permits the interpretation that the glomerular changes in this disease are of extreme intensity. On the basis of our results, indeed, the permeability of the glomerular capillaries in eclampsia appear to undergo greater alterations than are encountered in any other condition with the exception of amyloid degeneration of the kidney. Accordingly, these biochemical findings afford further evidence that increased capillary permeability may play an important rôle in the pathology, and perhaps even in the etiology of eclampsia.

It has been noted in a previous communication[9] that in pregnant patients suffering from nephritis, heavy protein excretion in the urine is accompanied in almost all cases by a protein deficit in the blood plasma and that when the serum proteins fall below 5 grams per 100 c.c., general edema is usually present. The relation between protein deficit and edema formation in our previous series was not, however, strictly regular and uniform, and consequently it was concluded that in addition to the diminution in serum proteins, some other important factor must be concerned in the water balance of these patients. A study of the present series of eclamptic patients lends further

support to such a supposition, in that 6 of them manifested marked general edema, yet showed serum proteins well within the normal range. We feel that it is significant in this connection that during the first weeks of acute glomerular nephritis (like eclampsia, a disease associated with high urinary globulin) edema may occur even though the plasma protein level is normal. Van Slyke and his associates[10] hold that the edema must be due to some factor quite apart from the osmotic effects of the plasma proteins and believe that it may result from some toxic action which increases capillary permeability. Certainly in conditions in which the capillaries are so permeable as to permit the passage both of albumin and globulin, the osmotic effect exerted by the plasma proteins, which is dependent upon the integrity of the separating membrane, must be minimal. It accordingly appears probable that in eclampsia, just as in acute nephritis, increased capillary permeability, even more than diminution in plasma protein, must be the dominating factor in producing general edema.

In the early part of this study it was hoped that the determination of the urinary albumin:globulin ratios in the toxemias of pregnancy might be of considerable diagnostic and prognostic help. In general, however, this is not the case. In the first place, in order to determine this ratio accurately, it is necessary for the urine to contain at least 3 gm. of protein per liter, a fact that at once excludes a great number of patients in whom hypertension rather than proteinuria is the outstanding clinical sign. It has been our experience, moreover, that patients who do show 3 or more grams of protein per liter are just the ones in which the usual diagnostic criteria are most conclusive, so that from a practical point of view the consideration of the albumin:globulin ratio becomes unnecessary.

CONCLUSIONS

1. The urinary protein excreted in eclampsia is characterized by an extremely high globulin content, the urinary albumin:globulin ratio in this disease averaging about 3.

2. In nephritis and nephrosis complicated by pregnancy, the urinary albumin:globulin ratios are higher; averaging in the present series 6.7 for nephritis and 13.3 for nephrosis.

3. It is suggested that the high globulin content of the urine in eclampsia is a direct result of the increased capillary permeability associated with that disease.

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A SIMPLE TECHNIC FOR CESAREAN SECTION UNDER LOCAL INFILTRATION ANESTHESIA*

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CESAREAN section, as performed, with the incision in the mid line between the umbilicus and the symphysis, is particularly well suited for the use of local infiltration anesthesia. There are three reasons for this. First, the lower segment of the uterus is directly below the incision; second, there is no necessity for extensive wound retraction and third, the intestines are rarely encountered, thereby making laparotomy pads unnecessary.

There are several advantages in this procedure which fully justify its use. Local anesthesia does not impair the contractility of the uterine muscle so that there is usually much less bleeding than there is when a general anesthetic is given. The postoperative convalescence is usually quite comfortable, vomiting rarely occurs, there is generally but little distention and smaller amounts of opiates are required than when a general anesthesia is administered. There are none of the disadvantages of inhalation or the potential dangers of spinal anesthesia.

Active labor is not a contraindication, but the patient will continue to have labor pains until the uterus is emptied. Local anesthesia is of special value when labor has been unduly prolonged and the patient is suffering from acidosis. Nephritis, pulmonary and cardiac disease are important indications for its use.

We have found no disadvantage in the use of this method. For the nervous type of woman, or for one who fears an operation, inhalation anesthesia may be better suited. Private patients, or those who have been about the ward for a time, are usually very good subjects because we become better acquainted with them and they have less operating room phobia.

As the use of local infiltration anesthesia for this operation is well established in this country, my purpose in this paper is to detail a simple and satisfactory technic and, in addition, to discuss briefly some of our results.

TECHNIC

Three hundred cubic centimeters of a sterile solution of 0.5 per cent novocaine to which one c.c. of 1-1000 solution of adrenalin chloride has been added, is prepared. This is the formula of the solution used at the DeLee Clinic. A syringe of the Labat type, preferably with ring handles, and two needles are the only special instruments required. One of these two needles is of small size, for the

*Read at a meeting of the New York Obstetrical Society, March 10, 1931.

initial wheal and the other, No. 50.7 (A. F. Co.), 5 cm. long, is used for the remainder of the infiltration.

The usual preparation for a laparotomy is made. The patient is placed in a slight Trendelenburg position and made as comfortable as possible. A thick mattress on the operating table is advantageous. The eyes should be covered with a towel and the ears loosely plugged with cotton so that the patient is not disturbed. Small amounts of cracked ice may be given during the operation.

The skin is infiltrated along the median line below the umbilicus. Novocaine should be injected as the needle is advanced and withdrawn, keeping it close to and parallel with the skin. The lower part of the skin area, the portion near the symphysis, must be infiltrated fanwise. This is most important. When the patient does not feel a skin prick, the skin and fat is opened down to the fascia. This is then infiltrated in the same manner and opened. Dissection, so far as possible, is made with a sharp scalpel, rather than with scissors and all the tissues must be handled very carefully. The needle is then placed in four positions, two on either side, through the fascia at right angles to the incision for a distance of 2 to 3 cm. and 5 c.c. of novocaine is injected into each area. The purpose of these injections is to anesthetize the deeper branches of the dorsal and lumbar nerves, as demonstrated at the DeLee Clinic. A small opening in the parietal peritoneum is then made at the upper angle of the wound, Allis clamps are attached on either side of this opening and the peritoneum is infiltrated a needle's length. This infiltrated area is then incised, the clamps are shifted lower and the procedure repeated until an adequate opening has been made. As the parietal peritoneum is the most sensitive tissue encountered, great care must be exercised at this stage. Except for the fingers of the assistants, we use no retractors at any time, all retraction of the wound being done with extreme care. The greatest discomfort is caused by pulling the parietal peritoneum. The visceral peritoneum over the lower uterine segment is then infiltrated so that this loose tissue is raised from the muscle. This facilitates the dissection of the two flaps in the low flap operation. A hypodermic injection of ¼ gr. of morphine sulphate (gm. 0.016) and $\frac{1}{100}$ gr. of scopolamine hydrobromide (gm. 0.0006) is given to the patient during the dissection of the flaps. It is given at this late stage to prevent untoward effects on the baby. One cubic centimeter of pituitary extract is given just before the uterus is opened. An inhalation of nitrous oxide and oxygen is now given for about one minute, while the uterine muscle is incised and the baby withdrawn. The uterine muscle is not sensitive but the change in intraabdominal pressure caused by extracting the baby, makes this step painful unless the gas is given. The placenta is removed by making traction on the cord. The uterine incision is closed with interrupted chromic catgut sutures superimposed by a continuous plain catgut suture of the Cushing type. The upper flap is now attached to the uterus on either side of the uterine incision and the lower flap drawn well up and sutured with a continuous plain catgut suture. The most important feature in closing the abdomen is the suture of the parietal peritoneum, which must be done with little traction. A small, sharp, cutting needle is better for this purpose than the usual round one. The remaining layers of the abdomen may be closed in the customary manner, no further injection being necessary. Often the patient is comfortably asleep at the conclusion of the operation.

I wish to report briefly 32 personally performed operations and 26 others from the Second (Cornell) Obstetrical Division at Bellevue Hospital and from the Manhattan Maternity and Dispensary. The indications in these cases were: contracted pelvis, before and after trial labor; central and partial placenta previa; accidental hemorrhage; preeclamptic toxemia of pregnancy and nephritis; pulmonary tuberculosis and cardiac disease. In short, these were all the usual indications for cesarean

section. No maternal deaths occurred and there were but two serious complications in the personal series. One patient with nephritis had a severe bronchitis and coughed so much after the operation that the abdominal wound opened. General anesthesia was given and the wound resutured, following which she developed bronchopneumonia, but recovered. A second patient developed a double femoral phlebitis, necessitating a long stay in the hospital. In our 1930 series at Bellevue Hospital we had some superficial wound infections, none of which was serious. This also occurred when general anesthesia was used, so could not be attributed to the use of the local infiltration. There were several instances of morbidity, as defined by obstetric standards, but the cause was usually evident and had nothing to do with the operation per se. We may conclude that anesthesia by local infiltration offers a simple and effective method for performing the operation of cesarean section, either of the so-called low classical or flap splitting type.*

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(For discussion, see page 892.)

NUPERCAINE SUBDURALLY IN OBSTETRICS†

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WE HAVE used novocaine by lumbar injection in 1,788 out of a total of 8,503 deliveries up to March 1, 1931. Failure of anesthesia has been less than 2 per cent; there have been no mortalities; worrisome immediate reactions have been few in number and limited to our earlier inexpert period. Headaches followed in 18 per cent; of these 20 per cent, or 3.6 per cent of the total, have been severe for a few days; two cases only (0.11 per cent) lasted four and twelve weeks respectively, but finally disappeared completely. One case of mild paresthesia of the thigh lasted eight weeks.

This type of anesthesia has commended itself because it is absolute; the patient's consciousness is retained for a certain amount of voluntary cooperation; good technic is maintained by quietude of posture; patients with respiratory infections, acute or chronic, with heart disease, nephritis, diabetes, hypertension, and toxemia, are spared the noxious effects of inhalation anesthesia; the fetus has no apnea whatever due to the anesthetic, even after the late use of morphine.

Therefore we consider it the method of choice for the operative termination of the second stage of labor. It is restricted to this, however, by its short duration, which does not exceed an average of about forty-five minutes. It has no place, therefore, as a first stage analgesic. This we have regretted because we believe that if an agent could be found which would give anesthesia prolonged to the duration of aver-

*When this paper was read I stated that "since the completion of this paper we have done five more cases, making a total of sixty-three." Several days later one of these patients died. At autopsy the uterine wound was found to be infected and peritonitis had developed. The operation was in a clean, elective case.

†Read at a meeting of the New York Obstetrical Society, March 10, 1931.

age labor, it might be possible to attain the ideal of a painless labor without danger to the mother or the infant.

In nupercaine we hoped we had found such an agent. It is manufactured by the Ciba Company; was introduced in Europe under the name of percain in 1929, and in this country as nupercaine, late in the same year. Chemically it is hydrochloride of alphabutyloxycinchoninic acid diethylethylen dioxide; it is offered for topical use, local infiltration, spinal and caudal injections. Its chief claim is said to be the very long duration of the anesthesia as compared with that of other agents; it has been said to produce spinal anesthesia lasting an average of eight hours.[1]

The spinal anesthetic dose advised is 10 mg. in 1:200 solution; much larger doses have been safely used, and appear to be within the toxic limit. But following the principle of keeping the obstetric dose definitely smaller than that necessary in the more extensive manipulations of general surgery, we have used only 5 mg., injected into L-3 or L-4. We have used it in 51 patients since October 1, 1930, and have used for comparison during the same period, 33 patients in whom spinal novocaine was employed, and 50 patients who did not receive any form of subdural medication. Such comparison gives the following results:

Spontaneous Delivery	
Primigravidae	
No Anesthetic*	17 out of 17 cases—100 %
Nupercaine	1 out of 8 cases— 13 %
Multigravidae	
No Anesthetic	31 out of 32 cases— 96.9%
Nupercaine	24 out of 35 cases— 68.5%
All cases	
No Anesthetic	48 out of 49 cases— 97.9%
Nupercaine	25 out of 42 cases— 59.5%

All of the cases in this table were carefully chosen to eliminate known dystocia in relation to the present labor. Therefore there should have been about the same proportion of spontaneous deliveries in the group submitted to nupercaine as in the group not so treated, provided nupercaine did not interfere with the labor. But the table exhibits an average reduction of nearly 40 per cent of spontaneous deliveries in the nupercaine group.

A comparison of the duration of labor shows the following:

	Spontaneous Labors	
	Primigravidae	*Multigravidae*
No anesthesia	12 hr. 35 min.	8 hr. 25 min.
Nupercaine	16 hr. 53 min.	11 hr. 41 min.

(This table exhibits definitely a prolongation of the duration of labor by nupercaine.)

*"No Anesthetic" in this table means none except small whiffs of ether in some of the cases, at the termination of the second stage.

Both these actions are due to the fact that spinal anesthesia by any agent lessens the efficiency of labor, probably partly by diminution of the force of uterine contractions, and more effectively by practically eliminating the action of the auxiliary forces. Nupercaine does not differ in any degree from other agents in this respect.

Amnesia is not present. The relief of pain during the anesthesia is complete, but patients will evaluate this relief variously in relation to the pain suffered before the anesthetic is administered, so that their net impression of the "painlessness" of the labor gives but indefinite information, and statistics are of only very broad value. Three out of 29 patients (10.3 per cent) who had no anesthesia, stated that labor was "not painful." The same statement was made by 2 out of 21 patients (9.5 per cent) whose second stage was terminated under inhalation anesthesia and by 54 out of 84 patients (64.5 per cent) whose second stage was terminated under spinal anesthesia. So that the lasting impression of their labor experience would seem to be definitely better in the group delivered under spinal anesthesia.

In our vaginal deliveries the standard dose of novocaine is 50 mg., as compared to average doses for general surgery of from 120 to 150 mg. The percentage of unsatisfactory anesthesia is less than 2 per cent.

For similar purposes we used in this series 5 mg. of nupercaine, the average surgical dose being 8 to 10 mg. The anesthesia was variously incomplete or unsatisfactory in 18 out of 51 cases, or 35.5 per cent, even after a lapse of fifteen minutes or longer following injection, 10 per cent being so imperfect as to require supplemental anesthesia. (Keys and McLellan,[2] who were among the first to report the use of this drug from an American clinic, had 21.7 per cent of imperfect anesthesias.) We recognize that the small dosage used may be responsible for these results, but if the employment of full dosage for restricted fields of work is necessary, then nupercaine is less flexible than other agents with which the dose may be varied in proportion to the extent of anesthesia required. In estimating the above results, all cases have been eliminated in which there was any possibility that unsatisfactory anesthesia depended on failure to properly introduce the anesthetic agent into the canal.

The duration of anesthesia varied from two to six hours, the average for the whole group being four and one-half hours, the average for two-thirds of the group, five hours. This substantiates the claim of nupercaine for much longer duration of anesthesia than other agents (novocaine, average forty-five to sixty minutes, maximum not in excess of two hours). Such prolongation of anesthesia is of inestimable value in some types of surgery, but is not sufficient to cover the duration of the first and second stages of average labor.

We found no evidence of shock or respiratory embarrassment. Blood pressure fall has been negligible in the dose we have employed

(50 mg. ephedrine is used as routine preliminary medication). There has, however, been nausea or vomiting in nearly half the cases and headache in 90 per cent of cases. The latter has impressed us as being excruciatingly severe in nearly all the cases in which it has occurred, and begins within three to six hours after the injection, instead of some considerable time later, as is generally the case with novocaine. We do not recall having observed headache from intraspinal novocaine which is of comparable severity to that observed with nupercaine. In Vienna also there was an acknowledged incidence of headache in about 30 per cent of cases.[1] In fairness it must be stated that Keyes and McLellan[2] had only one "spinal headache" in 46 cases, and only 3 cases of postoperative vomiting. Francis C. Edgerton "has used nupercaine . . . . in over 300 cases with infrequent occurrence of headache."[3] At Bellevue Hospital,[4, 5, 6] where nupercaine has been used on the surgical and genitourinary services, there have been no more headaches from nupercaine than from novocaine; on the fourth surgical division headache has not been noted.

We are at a loss to completely account for our own high proportion of headaches, because our technic has been identical with nupercaine and with novocaine, and does not differ essentially from that used in the other clinics quoted, except that our dose is smaller.

We constantly observed very much increased cerebrospinal fluid pressure during uterine contractions and voluntary bearing down efforts. During labor, uterine contractions, more or less modified in force, persist under spinal anesthesia, and in our patients the voluntary use of the auxiliary forces is frequently encouraged. Therefore we can assume that in the obstetric use of spinal anesthesia there is a factor which consists of sharp change in cerebrospinal fluid pressure not present in its surgical use. Such a factor may be of importance in the production of anesthetic headache. It is perhaps significant in this regard that patients who have had cesarean section under spinal anesthesia are less apt to suffer from headache than are those who have delivered vaginally under it. In the section cases the uterine contractions against resistance do not persist long after the injection, and voluntary bearing down efforts are entirely eliminated.

Obstetric sequelae attributable to the anesthetic other than the increased incidence of operative delivery, have not been noted.

SUMMARY

1. Spinal anesthesia is of great usefulness in obstetrics, as an anesthetic for the operative termination of labor.

2. Nupercaine is less desirable than novocaine for such purpose because: (a) Perfect anesthesia is not so uniformly obtained. (b) Symptomatic reactions, nausea and vomiting, and especially very severe headache, are more frequent. (c) The acknowledged longer duration

of anesthesia due to nupercaine does not constitute an advantage in obstetric practice sufficient to offset the disadvantages noted.

Acknowledgment is hereby made of much painstaking work in handling and observing the material for this report, to Jessie D. Reed, M.D., Chief Resident Obstetrician, Jersey City Medical Center.

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(For discussion, see page 802.)

SARCOMA OF THE UTERUS

BY LOUIS P. KASMAN, M.D., BROOKLYN, N. Y.

(From the Koster Clinic, Crown Heights Hospital)

SARCOMA of the uterus is not as rare a disease as most of the textbooks claim. This is particularly true of those sarcomas which develop from fibromyomas of the uterus. The sarcomatous growth developing from the uterine mucosa and usually assuming the botryoid form is another rather rare type of tumor. Yet the most unusual and clinically most puzzling type of sarcoma is that which develops within the wall of the uterus. Such an intramural sarcoma came to our observation and shall be reported as follows:

A female patient aged fifty-three was admitted into the hospital August 15, 1930. Patient's history revealed that in the early part of May, 1930, she was given radium treatment in order to stop irregular uterine bleeding due to a fibroid uterus. Fifty millicures of radium were inserted into the uterine canal and were permitted to remain there for twenty-four hours. Bleeding stopped within the next twenty-four hours and the patient remained well until August 14, 1930, when she was suddenly seized with severe cramp-like pains in the lower abdomen. She also felt faint and nauseated. Vaginal bleeding started again. Examination revealed tenderness and rigidity in the lower abdomen equal on both sides. Pressure-release tenderness was present in the lower abdomen. Vaginal examination revealed the cervix in normal axis, normal consistency, and closed. The uterus was freely movable, anteverted, anteflexed, and enlarged to the size of a two months' pregnancy. There was a suggestion of a mass present on the posterior superior surface of the fundus. The remainder of the examination was essentially negative.

Urine examination was negative. W. B. C. 14,100, polymorphonuclears 82 per cent, lymphocytes 14 per cent, monocytes 4 per cent, hemoglobin 75 per cent, R. B. C. 3,800,000. A preoperative diagnosis of a twisted fibroid of the uterus was made. A laparotomy was performed under spinal anesthesia. A large amount of free blood was found in the peritoneal cavity. There was a perforation of the fundus of the uterus about 1 cm. in diameter to which a fold of the sigmoid-junction was adherent. Both tubes and ovaries showed the evidence of a chronic inflammatory condition. A chronic obliterative appendicitis was found. A supraecervical hysterec-

tomy and appendectomy were performed. Patient made an uneventful recovery and was discharged from the hospital August 31, 1930.

The removed uterus was about the size of a small grapefruit, of irregular shape with an eccentric enlargement on the left side of the fundus. Slightly toward the posterior surface near the fundus there was an irregular defect, about 2 cm. in diameter filled with bloody material. This defect led into a cavity within the uterine wall. Section made through the entire uterus showed a thickened and somewhat fibrotic uterine wall without any intramural or subserous fibroid nodules. The uterine cavity appeared like a narrow rent with a slightly thickened and congested mucosa. The cavity which opened upon the surface was very irregular in shape and was surrounded by a somewhat softer mushy tissue which bulged into the cavity in the shape of cauliflower-like projections. These projections were covered with a bloody material. Similar material filled out the smaller spaces between these projections. The color of the tissue from the wall of the cavity was of a grayish white color with pinkish mottlings. This tissue was not very sharply demarcated from the surrounding uterine tissue.

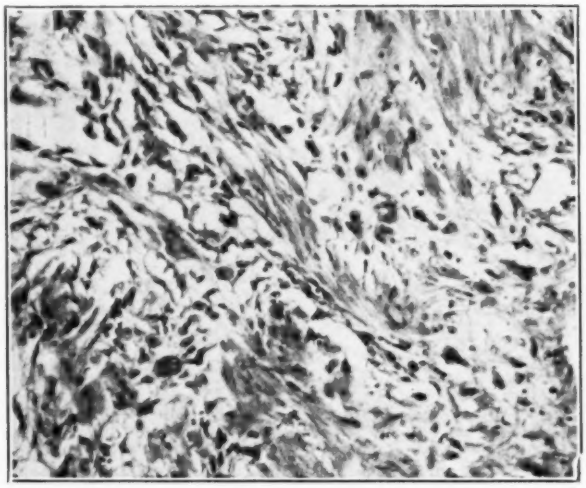

Fig. 1.—Intramural sarcoma of the uterus. Remnants of the myometrium are surrounded by the sarcoma tissue which shows polymorphous nuclei and a reticulated stroma.

On microscopic examination the tumor tissue forming the wall of the cavity consisted of very irregular polymorphous cells, most of which were spindle shaped or stellate. They were interconnected with a network of fine fibrils which did not stain well with acid dyes. The nuclei were of unequal size and shape. Some of them were hyperchromatic, others were more vesicular with irregular distribution of their chromatin.

Examination of the borderline between the tumor tissue and the uterine musculature showed that the tumor cells invaded the myometrium and forced their way between the larger bundles of the musculature. Islands of tumor cells were found between the muscle bundles at a distance and were apparently not directly connected with the main mass of the tumor. Invasion of veins or lymph vessels could not be ascertained. The diagnosis of a mixed cell sarcoma was made. No decision could be derived at whether the connective tissue or the musculature could be considered as the matrix of this sarcoma.

C. Mayer in 1860 first described sarcoma of the uterus which was later confirmed by Virchow in 1867. G. Viet in 1867 described three cases of sarcoma of the

uterus, one of which was sarcoma of the cervix. In 1894 Williams reviewed the literature on sarcoma of the uterus and reported 144 cases. In 1901 Knott reviewed 118 cases collected from the literature during the preceding ten years. In 1905 Grad called attention to the benefits derived from the radiotherapy of sarcoma of the uterus. Between 1907 and 1909 Taylor reported three cases of sarcoma of the uterus. Masson in April, 1923, reviewed the literature from 1894 to 1923 and reported 200 cases. Bunton reported nine cases from 1923 to October, 1925. This brings the number of cases reported up to October, 1925, to a total of 353 cases. From October, 1925, to the present date on reviewing the literature we have collected 39 cases of sarcoma of the uterus of which seven were mixed tumors.

We have had three cases of sarcomatous degeneration of fibromyoma and one case of an intramural sarcoma of the uterus. This brings the total number of sarcoma of the uterus to be reported in the literature to 396 cases.

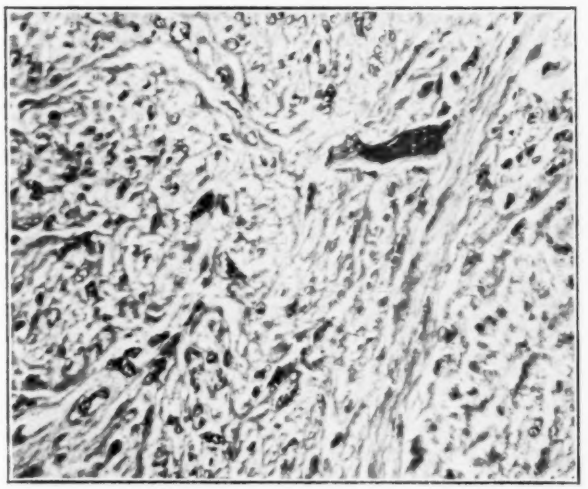

Fig. 2.—Incipient sarcoma in fibromyoma of the uterus. Note the polymorphous and occasional giant nuclei.

The unusual feature of our case of intramural sarcoma from a clinical point of view was that lying close to the serous surface of the uterine wall it perforated into the abdominal cavity causing internal hemorrhage. Reviewing all the literature we have not been able to find any similar case on record. It will remain an open question whether radiotherapy applied in this case was responsible for the outcome; that is, for the breaking down of the center of the tumor and its perforation into the abdominal cavity with hemorrhage.

While cases of this type must be considered as extremely rare the so-called sarcomatous degeneration of fibromyomas seems to be so much more common. Among the 154 fibromyomas operated upon in the Koster Clinic during the last year there were three cases of sarcomatous degeneration. Two cases appeared to us as very early stages of the growth and were recognized during the routine examination

of the tumors. These fibroids were grossly not different from any of the other tumors and only microscopic examination revealed scattered areas of greater cellularity in which the densely packed nuclei were highly polymorphous and showed occasional mitotic figures.

Diagnosis of such incipient sarcomatous degenerations should be made with great care as areas of greater cellularity are very common in ordinary benign fibromyomas. A certain degree of polymorphism is also met with not infrequently in such tumors, particularly in the neighborhood of areas of liquefaction and other degenerative changes. They express necrobiotic changes rather than evidence of incipient malignancy.

The third case which we observed showed grossly a distinctly different behavior. The report of the case is as follows:

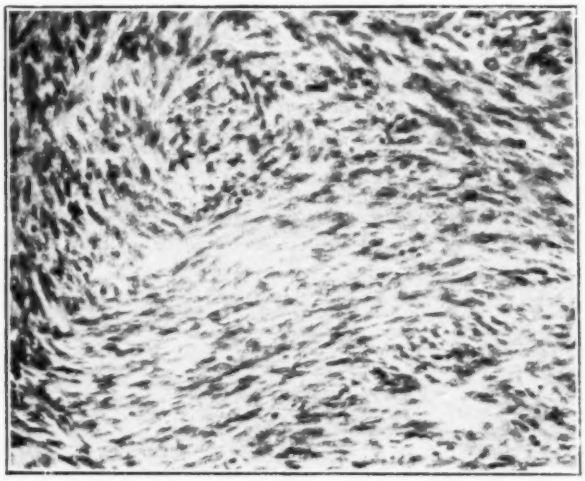

Fig. 3.—Sarcomatous changes in fibromyoma. The cells are densely packed with but little fibrillar stroma. The nuclei are irregular.

A female patient aged forty-seven was admitted into the hospital November 13, 1930. Patient's history revealed that for the last year her menstrual period which usually lasted three days became prolonged to eight days. She also had intermenstrual bleeding and a dragging-down pain in the pelvis. On examination a large mass was palpable in the lower abdomen and reached halfway up to the umbilicus. There was no fluid palpable in the abdomen, no points of tenderness. On vaginal examination the cervix was pointing posteriorly, uterus was enlarged to the size of a five months' pregnancy and was freely movable. Diagnosis of fibroid uterus was made. A laparotomy was performed and a large fibroid uterus was found. Right ovary was cystic and enlarged. Gall bladder showed the evidence of a chronic inflammation and contained stones. A supracervical hysterectomy, right salpingo-oophorectomy, appendectomy, cholecystectomy, and perineorrhaphy were performed under spinal anesthesia. Patient made an uneventful recovery. Discharged November 28, 1930.

The specimen showed a considerably enlarged uterus which was the size of the head of a newborn infant. It was globular but somewhat irregular in shape. On cutting the specimen in half a single globular tumor was found which was placed

intramurally, causing a subsequent distention and compression atrophy of the surrounding uterine tissue. The uterine cavity was eccentrically displaced and slightly distended and showed a somewhat thickened and shaggy mucosa. The tumor itself consisted of two portions. The main portion was firm and of a fibrillar structure with irregular whorl-like arrangement of the bundles. The other portion which was crescent-shaped separated the main tumor from the uterine wall. This portion was very soft, edematous, and contained many small irregular cystic cavities. A few larger fluid-filled spaces were also found. The gross inspection of this tumor aroused our suspicions as to its malignancy by the following facts:

1. The deeper yellow color of the main tumor.
2. The very irregular arrangement of its bundles.
3. The relative softness of this tumor as compared to other solid fibromyomas.

The extensive degeneration of the outer crescent-shaped portion of the tumor also pointed to a more rapid growth of the inner portion causing a successive compression and lymph-stasis of the section not involved in the secondary malignant proliferation.

Histologic examination revealed a tumor similar in its architecture to an ordinary fibromyoma, yet of enormous cellularity. The nuclei of these cells were densely packed and their size and shape were very irregular. Their chromatin content was increased. Mitosis was occasionally met with. In the less dense areas the relationship of the nuclei to the fibrils could be studied and ascertained and showed the characteristics of smooth muscle cells. The staining of the fibrils also indicated that the tumor was essentially a leiomyosarcoma as the fibrils with little exception did not stain well with eosin or acid fuchsin.

Section stained with Mallory's aniline-blue-orange mixture showed the presence of quite numerous blue-stained fibrils even in the most cellular areas of the tumor. Yet many other fibrils in the same or in other places did not take the blue stain disclosing their noncollagenous nature. It would seem that the cells of this tumor are of a double nature inasmuch as they are derived from a double matrix. Part of the cells are derived from smooth muscle tissue while others descend from fibroblasts. The double nature of these cells can be verified only on the more matured individuals which were capable of forming fibrillar substances.

Comparing this case of advanced sarcomatous degeneration of fibromyoma with slides from the more incipient cases we cannot exclude the possibility that there is a component in the sarcomatous growth which is derived from fibroblasts.

TABLE I. STATISTICAL DATA

MYOMA EXAMINED BY	TOTAL NO.	SARCOMA NO.	PER CENT
Evans	4000	72	1.8
Kelly and Cullen	1400	17	1.2
Berreiter	716	6	0.83
Williams	4115	8	0.19
Tracy	3561	54	1.5
Gurlt	4115	8	1.8
Noble	2274	34	1.4
Von Franque	3366	16	0.47
Gessner	9133	18	0.19
Veit	42395	40	0.09
Vogt	1216	30	2.37
	72116	300	0.41

Comparing the various statistics published in the last fifteen years of sarcomatous degeneration of fibromyoma we arrive at an average figure of 0.41 per cent. The estimate percentages of the individual

authors vary from 0.09 to 2.37. (See Table I.) This would indicate that the frequency of sarcomatous fibromyomas increases with the care taken at histologic examination of the specimens. The collection of over 42,000 cases in which only 40 sarcomas were found (0.09 per cent) makes us believe that some were overlooked. The remaining 30,000 cases with 260 sarcomas bring the average figure close to 1 per cent. This figure compares better with our observations of three sarcomas in 154 cases (close to 2 per cent) and would emphasize the importance of careful examination of any uterine fibroid tumor removed.

SUMMARY

Four cases of uterine sarcoma are reported, one of which is a primary intramural sarcoma, perforating into the abdominal cavity and causing internal hemorrhage. The other three cases show gradations of sarcomatous degeneration of fibromyoma.

The relative frequency and importance of sarcomatous degeneration in uterine fibromyomas is emphasized.

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NORMAL PREGNANCY IN A PATIENT WITH PREEXISTING COMPLETE HEART-BLOCK

By R. S. Titus, M.D., and William B. Stevens, M.D.,
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THE case to be described is reported because of the rarity of records of the occurrence of childbirth in patients with preexisting complete heart-block. When the patient under consideration requested that she be allowed to become pregnant, we could locate published reports of only four similar cases that had been permitted to go through to full term.

In 1927 Jeannin and Clerc[1] reported a case with a 2-1 heart-block and occasional attacks of vertigo and faintness who went through pregnancy spending the last two months in bed, and after twelve hours of labor was delivered by vaginal cesarean section. The circulatory efficiency was normal during labor and nine months later examination showed no evidence of further cardiac damage. In a discussion of this case a similar instance was mentioned by M. Laubry.[2] Again, in 1927,[3] two cases of pregnancy with heart-block were reported from Germany. The first patient was in labor twenty-three hours with a rise in ventricular rate from 36 to 52 per minute and a drop to between 40 and 50 after spontaneous delivery. Four years later this patient showed no evidence of damage to the heart, and the left border as detected by x-ray examination was 9.5 cm. to the left of the midsternal line as compared to 10.2 at the beginning of the pregnancy. The second case of complete heart-block with diphtheritic etiology was delivered of an eight months' premature infant without difficulty. Examination of the mother four months after labor showed the cardiac function to be competent. The left border of the heart was 9.5 cm. from the midsternal line; and complete heart-block was verified by means of an electrocardiogram. In various surveys of the condition of the heart in pregnancy by James McKenzie,[4] Wilson et al.,[5] and in obstetric textbooks, no mention is made of patients with preexisting complete heart-block who have become pregnant. Recently[7] a patient with complete heart-block who had six deliveries without incident has been mentioned briefly in a survey of the heart in pregnancy. We feel that the coincidence cannot be as rare as would appear from the literature, especially since heart-block in young people[6] is recognized as being not especially unusual.

On the basis, then, of the above cited cases with uneventful delivery, the patient reported here was allowed to become pregnant after both she and her husband understood that the risk was greater than in a normal person.

L. B., a minister's wife, twenty-five years old, first consulted Dr. F. Gorham Brigham* in 1925 because of easy fatiguability and nervousness. Her parents both died of unknown cause before she was nine years old, so that she knows very little of her early medical history. There is no evidence that she had diphtheria or any other severe infection in childhood. At the age of twelve years casual examination

*We are indebted to Dr. F. Gorham Brigham for the use of his records and valuable supervision throughout the course of the case.

by a physician showed that she had a "very slow pulse." She had no symptoms referable to her heart, however, until at the age of nineteen years when she suddenly fainted while playing field hockey, and later was told she almost died. She refrained from competitive sports, but after graduation from college worked hard as a social worker, and at the age of twenty-two years was married. She has carried her full share of the mental and physical load that her position as minister's wife in a large rural church demands. In the summer of 1927 she climbed a mountain of 3,000 feet within three hours, without any particular difficulty. Her past history is otherwise irrelevant.

During the period of preliminary observation from 1925 to 1928, she exhibited symptoms referable to the heart only when tired. On such occasions she had a sense of heaviness in the precordium and rarely short stabbing needle-prick pains localized in this region. More rarely, when especially tired, she experienced a momentary dizzy feeling, but did not lose her balance or consciousness. There has been no dyspnea; rarely a moderate palpitation; no edema; and no failure of the cardiac compensation.

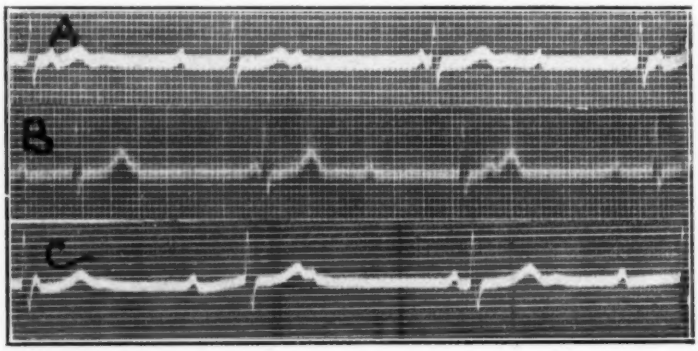

Fig. 1.—Lead I. Time marker 1/5 sec. Complete auriculoventricular dissociation. *A*. June 15, 1925. Three years before pregnancy. *B*. March 21, 1929. Nine days before delivery. *C*. June 27, 1929. Three and one-half months after delivery.

Physical examination in 1928 showed a sensitive, tall, rather thin woman who looked the picture of health. Aside from her rather small physique, the physical examination was negative except for the heart which was slightly enlarged. The apex was seen and felt in the 5th intercostal space 9.5 cm. from the midsternal line, and the left border of dullness corresponded to the same area. The right border was 3 cm. from the midsternal line and supracardiac dullness was 5.5 cm. in width. The cardiac rate was 44 per minute, with slight sinus arrythmia. The heart sounds were of good quality. The auricular sounds were not discernible. There was a harsh, loud, rather musical systolic murmur heard best at the apex but present all over the precordium. The systolic blood pressure was 110 mm. of Hg and the diastolic was 70 mm. of Hg.

The Wassermann test of the blood was negative. An analysis of the urine revealed no abnormal findings on several examinations. There was a moderate degree of "secondary anemia." The hemoglobin content of the blood remained between 65 and 75 per cent by the Tallquist method.

The electrocardiograms (Fig. 1) in 1925 and 1928 showed complete auriculoventricular dissociation, and a seven-foot roentgen-ray plate of the heart showed essentially no enlargement (Table I).

TABLE I. MEASUREMENTS FROM ELECTROCARDIOGRAM AND SEVEN-FOOT X-RAY PLATE OF HEART

DATE	VENTRICULAR RATE PER MINUTE	AURICULAR RATE PER MINUTE	LEFT BORDER CM.	RIGHT BORDER CM.	TRANSVERSE CM.	LONG DIA. CM.	BASE CM.	GREAT VESSELS CM.	CHEST CM.	CHEST TRANSVERSE PER CENT
6/15/25	44	73	7.7	4.1	11.8	12.3	8.4	5.6	21.9	53
12/ 8/27	45	68	7.5	4.2	11.7	13.0	9.3	5.5	21.5	54
9/ 6/28	45	75	7.7	4.4	12.1	13.2	9.8	5.7	21.8	55
10/11/28	50	78	6.5	4.3	10.8	12.5	10.1	6.0	21.7	50
11/15/28	58	82	8.0	3.9	12.9	12.4	9.1	6.2	22.4	58
12/14/28	50	72	8.6	4.4	13.0	13.8	10.5	6.5	22.7	57
1/31/29	54	88	8.7	4.1	12.8	13.5	9.8	6.0	23.7	54
3/ 6/29	58	76	9.0	4.3	13.3	14.3	9.6	6.0	24.3	55
3/21/29			8.5	5.4	13.9	14.5	9.9	6.1	24.0	58
6/27/29	38	57	7.6	4.4	12.0	13.2	8.7	6.0	21.9	55
11/21/30	38	60	7.3	3.7	11.0	13.5	10.2	5.9	22.3	49

The patient missed her first menstrual period in July, 1928. She was admitted to the New England Deaconess Hospital, August 20, 1928, with a threatened miscarriage, and was in bed for ten days when the flowing stopped. She then went home and rested. During this time obstetric supervision was first undertaken. She returned to the hospital once a month during her pregnancy and stayed each time for twenty-four hours. She was examined and weighed. A twenty-four hour urine analysis was made, and an electrocardiogram and seven-foot plate of the heart with fluoroscopic examination were obtained at each visit.

Certain observations relating to the heart during pregnancy are shown by the measurements in Table I. At no time were there any serious symptoms referable to the heart. The patient gained weight slowly, her systolic blood pressure remained between 120 and 130 and the diastolic between 70 and 80. There was a slight increase in the rate of both the ventricles and auricles as is shown in Table I. When the patient first entered the hospital the ventricular rate was often 10 beats per minute higher than that shown after she had relaxed and the electrocardiogram could be taken. Toward the end of December she became somewhat over-tired and complained of palpitation and a sense of constriction in the precordium toward the end of the day. Following this visit she took a period of rest after lunch every day, went to bed by 9:30 o'clock, and often had breakfast in bed. At her next visit all the cardiac symptoms had disappeared and they did not recur. On March 20, 1929, she was admitted to the hospital to stay at rest until she went into labor. Examination during this period showed the cervix entirely obliterated, very soft, and the head well engaged. She was therefore allowed to go into normal labor which she did after spontaneous rupture of the membranes at noon, March 31. At 3 P.M. she was having unsatisfactory pains and was given subcutaneously two minims of "infundin." Labor started satisfactorily and continued until 4:30 P.M. when the pains let up somewhat and she was given two more minims of "infundin." Inhalation of nitrous oxide was started as an analgesic at this time. At 5:30 P.M. the head was in sight, and under ether anesthesia, a low forceps delivery was done.

The child was normal in every way and cried immediately. During labor the patient's pulse reached a maximum rate of 76, was of good quality, and the patient was warm and pink. The cardiac rate dropped to 60 immediately after delivery and to 44 at the time of her discharge from the hospital three weeks after the baby was born. Convalescence was normal. The patient has taken entire care of the baby with help for the heavy house work only. She is doing more and more work in the church without any cardiac symptoms. Examination of the heart one year and eight months after delivery shows the auricular and ventricular rate to be the same as before pregnancy, the size by x-rays and percussion to be essentially the same. The heart sounds are of good quality, the loud systolic murmur still present but not changed in intensity or type.

DISCUSSION

The progress from the cardiac point of view is best seen from Table I and Fig. 1. It will be seen that there was a slight rise in both auricular and ventricular rates (as shown by the electrocardiogram) during pregnancy. Following delivery there was a drop in both the auricular and ventricular rates. There was also during pregnancy a gradual increase in the transverse and long diameters of the heart as measured from the seven-foot heart plates, all of which were taken by the same machine and as nearly as possible under the same conditions. How

much of this apparent enlargement was due to pushing up of the chest viscera by the fetus is difficult to determine, but a gradual increase in the chest diameter can be seen, especially in the later months of pregnancy. The percentage relation of the transverse diameter of the heart to the diameter of the chest has been computed (in the last column of Table I) as the simplest expression of any true enlargement of the heart. There was comparatively little change in this value, there being only a 4 per cent increase from 54 per cent six months before becoming pregnant to 58 per cent two weeks before delivery.

The patient stood labor well. There was no evidence of myocardial insufficiency, and the small doses of pituitrin given to improve the strength of uterine contractions caused no change in the blood pressure or heart rate. Examination and tests three, six, and twenty-two months following delivery including history, physical examination, heart plates, and electrocardiograms gave no evidence that the efficiency of the heart was reduced by this experience.

We feel, therefore, that a patient with complete heart-block having no demonstrable myocardial insufficiency or changing block may be allowed to go through a carefully supervised pregnancy. The question of the method of delivery is one which cannot be answered until the end of pregnancy and depends upon the condition of the cervix and the height of the presenting part. If, as in this case, the cervix is very soft, entirely obliterated, and admits one finger, with the head very well engaged before labor, it seems that normal labor is not only safe but conservative. On the other hand, if the cervix is not taken up, is not well softened, and the head is not well engaged, so that labor would probably be long drawn out, cesarean section might well be considered the operation of choice.

SUMMARY

A case is reported of a patient with preexisting complete heart-block, who went through pregnancy and a normal labor without showing evidence of any decrease in cardiac function.

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472 COMMONWEALTH AVENUE.

TWO YEARS RÉSUMÉ OF ABORTIONS IN THE LOUISVILLE CITY HOSPITAL*

By W. O. Johnson, M.D., F.A.C.S., Louisville, Ky.

(From the Department of Gynecology, University of Louisville Medical School)

IN THE following cases of abortions treated in the Louisville City Hospital between October 1, 1927, and October 1, 1929, we wish to bring out the frequency of abortions, and present the methods used in the gynecologic department in dealing with these conditions. This series of abortions is not comparable to the previous report made in the *Kentucky State Medical Journal.*

The 329 cases analyzed are divided into, threatened abortions, 41 cases, and incomplete abortions, 288 cases. The classification is made upon diagnosis after complete examination. In all of the cases the initial cause of the abortion began outside the hospital, and patients were either sent or came to the institution for treatment.

The percentages given are based on the total number of cases in each group.

In the group of threatened abortions, such signs in a normal pregnant person as slight flow, backache, or low pelvic pain, indicated the need of attention and are included here.

There were 41 cases in this group; 9.7 per cent of these completed the abortion after entering the hospital.

Among the cases of threatened abortions twenty-four years was the average age, seven the average hospital days, 87.8 per cent of the cases were said to be married, 21.1 per cent admitted being single, and 7.3 per cent intimated that they were divorced. Among those who had borne children, 3½ was the average number of children, and 3¼ the average number of previous abortions. Twenty-one and nine-tenths per cent of the cases admitted that the abortion was induced, and 7.3 per cent stated that the induction was started by a doctor.

Table I

CAUSE OF ABORTION	THREATENED ABORTION 41 CASES		INCOMPLETE ABORTION 288 CASES	
	CASES	PER CENT	CASES	PER CENT
Induced	9	21.9	63	21.8
Jar, fall, strain	6	14.6	46	15.9
Medicines	2	4.8	29	10.0
Catheter	2	4.8	23	7.98
Malposition	—	—	6	2.0
Physician	3	7.3	25	8.68
Cause unknown	19	46.03	96	33.33
Total	41	99.43	288	99.69

*Read before the Louisville Obstetrical and Gynecological Society, January 27, 1930.

Fourteen and six-tenths per cent of the cases attributed the onset to a fall, jar or unusual strain. Four and eight-tenths per cent of the cases used medicine, and a similar number resorted to vaginal packs.

The average duration of symptoms before entering the hospital was twelve days, estimating from the onset of bleeding to the date of entrance into the hospital. In 75.6 per cent of the cases bleeding was the first symptom, while 87.8 per cent of the patients complained of abdominal cramps, and 39.0 per cent had the usual nausea and vomiting associated with pregnancy. Only 2.4 per cent of the patients in this series had chills and fever, and with one exception all patients with chills and fever occurred in those where abortions had been induced.

Upon physical examination, lower abdominal tenderness was present in 56.0 per cent of the cases, and 54.6 per cent the uterus was large enough to be palpable through the abdominal wall. Twenty-three and four-tenths per cent had leucorrheal discharge. The estimated average duration of pregnancy was two and one-half months. There was no mortality.

TABLE II

	THREATENED ABORTIONS		INCOMPLETE ABORTIONS	
	CASES	PER CENT	CASES	PER CENT
White	30	73.1	239	82.9
Colored	11	26.8	49	17.0
L.O.A.	11	26.8	76	26.3
Readmitted	5	12.1	18	6.25
Previous spontaneous labors	4	9.75	51	17.1
Previous forceps deliveries	—	——	4	1.38
Previous cesarean section	—	——	3	1.04

The treatment in this group was absolute rest in bed, with the foot of bed elevated in 46.3 per cent of the cases. The patient was not allowed to move out of bed until she was free from symptoms for at least forty-eight hours. For the relief of pain, restlessness, and irritability, opiates were given in sufficient quantity to keep the patient quiet and comfortable. Morphine was used in 82.9 per cent of cases and codeine in 24.3 per cent; in some cases both drugs were used. The diet was simple, with little residue, fluids were urged, and the bowels were regulated with mineral oil or milk of magnesia. In 26.4 per cent of the patients ice-caps were applied to the abdomen. All vaginal discharge was carefully examined and no vaginal examination or manipulations were attempted. This outline was continued for forty-eight hours after the cessation of the symptoms, then the patient was allowed to resume slowly her usual activity and advised to avoid the conditions which had brought on the previous condition. Pelvic examinations were not made for seven to ten days after the symptoms had subsided.

This conservative supporting treatment is sufficient to bring about a satisfactory quiescence in cases of threatened abortion, but there are other types, such as deficient germ plasm or other abnormal conditions, which do not yield to the treatment outlined above. There are numerous symptoms by which these graver conditions may be recognized. If a hemorrhage occurs that is sufficient to soak five napkins in twenty-four hours, or if one lasts for several days, severe enough to prevent recovery of blood supply, as can be shown by blood count or hemoglobin determination, and subjective feeling of the individual, or if the patient has a characteristic rhythmic sharp pain in the lower pelvis or back which is not relieved by moderate doses of morphine, and if, in conjunction with any or all of the above, there is a rupture of the membranes, we may consider that we have an inevitable abortion.

TABLE III

DILATATION AND EVACUATION 29 CASES			
Duration of symptoms	28.1 days		
Hospital days prior to dilatation and evacuation	3.9 days		
Placental and remnants found	29	cases	100 %
Blood clots	8	cases	27.5%

The incomplete abortions number 288 cases. The average age was 25.7 years, with 9.8 average days of hospitalization. Seventy-nine and five-tenths per cent admitted they were married, 14.5 per cent were single, and 0.48 were said to be divorced. The average number of pregnancies in this group is four, with 2¾ the average number of previous abortions.

Twenty-one and eight-tenths per cent admitted that the abortion was induced, and 0.86 per cent stated that a doctor had started it. Sixteen per cent induced the abortion by taking medicines, and 14.2 per cent attributed the onset to a fall, jar or strain, and only 7.3 per cent had malposition of uterus to account for the condition. (Table II.) In this group the duration of symptoms averaged twenty-eight and one-tenth days. Vaginal bleeding was the first symptom in 79.1 per cent of the cases, abdominal cramps in 59.7 per cent of the cases, and passage of clots from the vagina in 43.4 per cent. The fetus was said to have been passed in 64.2 per cent of the cases before entrance into the hospital. Chills and fever were present in 13.1 per cent of the cases, and in every such instance, the abortion had been induced.

Upon physical examination 59.0 per cent had low abdominal tenderness. The uterus was palpable in 40.2 per cent of the cases; 10.4 per cent of the cases had positive Wassermann, and 25.0 per cent of the cases had albumin in the urine.

In 49.6 per cent the placenta was expelled after entering the hospital, and only in 16.6 per cent were the fetus and placenta expelled.

The average duration of pregnancy in this series was estimated to be four months, and the estimated average age of the fetus examined was three and one-half months.

Twenty-four and three-tenths per cent of the cases had a temperature of 99°-100° when they entered the hospital; among these, 34 per cent were patients who had induced their abortions: in the 26 per cent who had a temperature of 100° or over, 56 per cent had induced their abortions.

TABLE IV

INFECTED ABORTIONS	THREATENED ABORTIONS 41 CASES		INCOMPLETE ABORTIONS 288 CASES	
	CASES	PER CENT	CASES	PER CENT
Chills and fever	1	2.43	38	13.1
Temperature 99° to 100°	13	31.7	70	24.3
Temperature 100° to 104°	5	12.1	75	26.0
Number of induced	9	21.9	63	21.8

When the abortion is inevitable or incomplete the treatment differs from that outlined for threatened abortions. As the figures show, over 50 per cent of the patients entered the hospital with fever, and we know that every febrile abortion is potentially a serious condition which should be treated in a hospital.

After the patient enters the hospital systemic treatment is instituted at once including absolute rest, fresh air, forced feeding of a high caloric, low residue diet; the fluid intake is kept to 2000 c.c. day, or hypodermoclysis may be resorted to, and blood transfusion is given without hesitancy if desiccation or anemia is present.

The initial examination is made very cautiously and if there is definite evidence of complications outside of the uterus, even so slight an indication as abdominal tenderness, strict conservatism is observed, and the following treatment is directed toward the resulting complications and not the abortion.

TABLE V

MISCELLANEOUS DATA	THREATENED ABORTIONS 41 CASES		INCOMPLETE ABORTIONS 288 CASES	
Average age	24 years		25.7 years	
Hospital days	7		9.8	
Married	36 cases	87.8%	232 cases	80.5%
Single	5 cases	12.1%	42 cases	14.5%
Average pregnancy	3⅕		4	
Average abortion	3¼		2¾	
Duration of symptoms	12 days		28.1 days	
Initial symptom bleeding	31 cases	75.6%	228 cases	79.1%
Passage of fetus	6 cases	14.6%	185 cases	64.2%
Duration of pregnancy	2½ months		4 months	
Wassermann	5 cases	12.1%	30 cases	10.4%
Albumin	15 cases	36.5%	73 cases	25.0%

If upon speculum examination, under sterile precautions, we see remnants protruding from the dilated cervical os, they are gently

removed with placental forceps. The patients are given one-half c.c. of pituitrin every half-hour for six doses and at the completion of this course one drachm of fluid extract of ergot is given every four hours for four doses. Under this régime a severe hemorrhage seldom occurs, and it is rarely necessary to pack the vagina. In fact, the vagina is never packed except in rare and extreme cases of profuse bleeding, and this only long enough to tide over an acute emergency until the pituitrin and ergot have acted. Even if the bleeding continues and the membranes are not completely expelled, a dilatation and evacuation is not considered until the temperature has been normal for three days, and then under the most rigid aseptic operative technic. Hegar dilators are used to dilate the cervix, and, with an iodine sponge wrapped on dressing forceps the uterine cavity is swabbed out. With sterile gloved finger the uterine cavity can usually be examined with ease to detect any remnant of tissue. Forceful dilatation and rough handling with hands is contraindicated. After dilatation and evacuation the uterus is kept in contraction by ergot, and the iodine sponge is left in the cervix for twenty-four hours. With this routine there has not been a death from dilatation and evacuation, in the past two years, and in only 10 per cent of all these cases was dilatation and evacuation necessary.

There were three deaths in this series of 288 cases, or a mortality of 1.4 per cent. Two deaths occurred from septicemia, and one patient, entering the hospital almost moribund, died from hemorrhage.

SUMMARY

1. A more careful study of the products of conception together with an accurate knowledge of maternal conditions will aid in preventing a great number of abortions.

2. Induced abortions are rapidly increasing in number and are associated with a high morbidity and numerous complications which greatly impair the health of the individuals.

3. Threatened abortions should be handled most conservatively and no manipulation or packing instituted.

4. Conservative treatment of inevitable and incomplete abortions has proved most satisfactory in our hands. Only 10.0 per cent of the cases needed surgical intervention, and this was resorted to only after conservative measures had failed.

5. Septicemia was the cause of 66.6 per cent of the deaths in this series, 95 per cent of the infected cases were the result of induced abortions.

The public should know the grave dangers and complications resulting from induced abortions. A fuller understanding of the great risks involved would mean consideration and hesitation before the attempt is made.

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BALDWIN MODIFICATION OF THE JARCHO PRESSOMETER FOR TRANSUTERINE INSUFFLATION, PNEUMOPERITONEUM AND UTEROSALPINGOSTOMY

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THE intent of this article is to describe a modification of several preexisting instruments which will serve equally as well for Rubin tests, injections of opaque media and pneumoperitoneum. More specifically, it is a combination of a

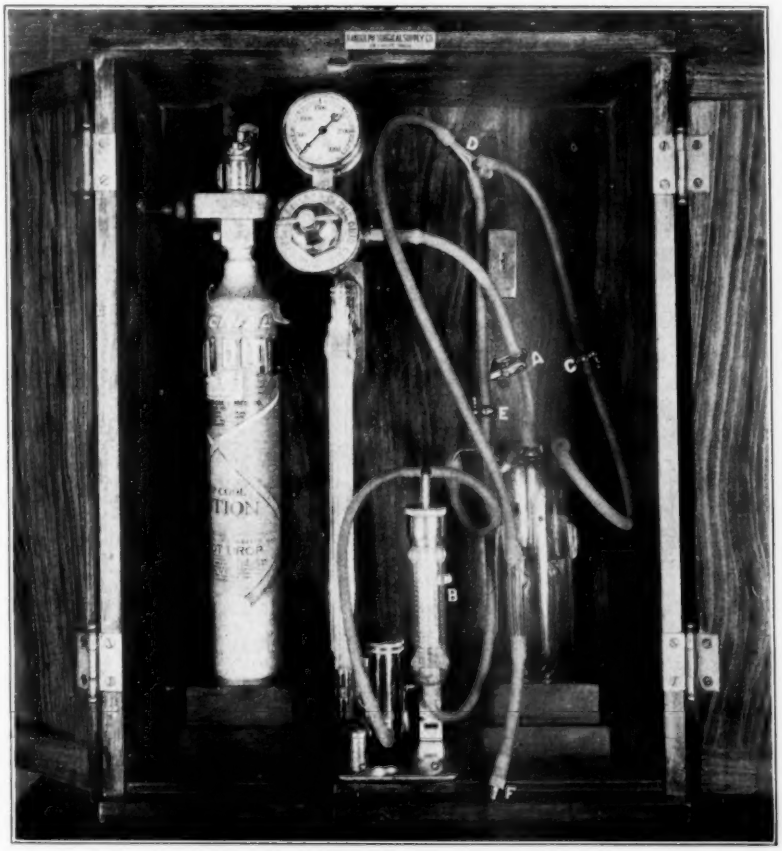

Fig. 1.

flow volumeter, a manometer and a cylinder for containing the opaque media. All of these units are familiar and have been fully described by others.

This particular arrangement was evolved in the Department of Obstetrics and Gynecology of the University of Michigan, in April, 1930. As is so often the case, a very similar hook-up was described several months before by Jarcho, over which we claim no priority although working without knowledge of his apparatus.

The instrument (Fig. 1) consists of a carbon dioxide cylinder which is connected with a Machlett siphonmeter. This in turn is connected with a Jarcho Pressometer, as made by Becton Dickinson and Company. These instruments are connected in such a way that they form a unit which can be used for either gas insufflation, pneumoperitoneum, or the injection of opaque media, singly or combined.

The carbon dioxide is used for pressure in all cases. The arrangement is shown in Fig. 1. The gauge and mixing valve connected with the gas tank controls the amount of gas delivered to the siphonmeter, which is further controlled by a Hoffmann clamp *A*. One outlet from the siphonmeter leads directly to the inlet of the lipiodol container *B*. The other outlet is equipped with a stopcock *C* and Y tube *D* and then leads to the patient. The opposite arm of Y tube *D* is connected with the lower end of the lipiodol chamber and is also equipped with a stopcock *E*. Adapter *F* is connected with a uterine cannula when in use. In the figure the Y tube is fastened to the back of the cabinet only for photographic reasons. As used, it is free.

In using the apparatus for gas insufflation, stopcock *C* is opened and *E* is closed; with this arrangement the gas passes through the siphonmeter and to the patient. The pressure is registered on the manometer. For the use of an opaque media, stopcock *E* is opened and *C* is closed. With this change the gas passes into the cylinder *B* and forces the opaque media toward the patient. This pressure is also registered on the manometer. It will be seen that the entire system, from cylinder *B* to adapter *F*, should be filled with the opaque media before the adapter is connected to the cannula, especially if the tubes are closed; otherwise the uterus will be filled with the air present in the tubing leaving no room for the opaque media and causing considerable pressure.

It is believed that this apparatus simplifies the procedures undertaken, and at the same time gives one a definite knowledge of the pressure exerted at all times. The entire apparatus is contained in a portable cabinet weighing twenty-one pounds and measuring 19½ inches in height, 14½ inches in width, and 7½ inches in depth.

595 E. Colorado Street.

Society Transactions

THE AMERICAN GYNECOLOGICAL SOCIETY

FIFTY-SIXTH ANNUAL MEETING

Hot Springs, Va.

MAY 18, 19, AND 20, 1931

The following papers were presented:

1. **The Preoperative and Postoperative Effect of Intravenous Glucose Solutions on the Cardiovascular Apparatus and Upon the Cellular Contents of the Blood,** by Dr. John O. Polak, Brooklyn, N. Y. (To be published later.)

ABSTRACT OF DISCUSSION

DR. HENRY T. HUTCHINS, BOSTON, MASS.—Dr. Polak has supplemented clinical data on glucose administration by an investigation into the physiologic action. We must get even more data from such investigations and from the physiologists who should tell us what strength we can use and what the actual physiologic reaction is. We started in first using glucose by rectum, then followed with the dilute solutions by vein, and now Dr. Polak wants us to push it up to a 50 per cent hypertonic solution in the vein.

I wish Dr. Polak had said more about the action of glucose in severe infections. We all recognize the value of their use. One of my colleagues had a case of general streptococcic septicemia, involving all the joints, following a ruptured appendix and general peritonitis. Glucose was given in that case, in 20 per cent solution, 500 c.c. by vein every other day for a period of well over a month. On the days on which the glucose was given the blood culture was negative to streptococci and on the alternating days it was positive. The patient recovered and we attributed part of the recovery to the glucose.

There are three fundamental uses for glucose. First, it is a food, therefore its use in preoperative and postoperative cases. Second, it is a carbohydrate, therefore its use in abating postoperative vomiting and the acidity of intestinal obstruction, shock, etc. Third, it will decrease the clotting time in jaundice, in gall bladder disease and disease of the ducts with dysfunction of the liver.

I believe in the use of insulin. Glucose will do no good unless it is oxidized. In cases of gall bladder disease and in cases where the pancreas is not acting insulin should be given in addition to the glucose.

DR. GEORGE GRAY WARD, NEW YORK CITY.—We have been using at the Woman's Hospital intravenous injections of glucose and gum acacia for a number of years, as brought out by Dr. Farrar before this Society. We have used a 20 per cent solution of glucose combined with a 6 per cent solution of gum acacia in many hundreds of cases and we have no cause to fear any untoward result from its use. Sir William Bayliss in London was the one who first showed the value of gum acacia in maintaining pressure and keeping the fluid in the vessels instead of having it seep out as it does with the ordinary saline solution given intravenously,

and as a result this work was taken up by Dr. Farrar and a clinical study carried out at the Woman's Hospital.

It is our custom in serious cases to give the intravenous solution during the operation and if necessary before and afterward. The technic of the administration is important. To prevent a reaction it is essential to give it slowly at the rate of 4 c.c. per minute, and at the temperature of 105° F., checked by a thermometer placed in the tubing. When properly given we have very rarely had any chill or reaction following. The quantity given is from 200 to 300 c.c., according to body weight. There can be no doubt that it is of very great value, especially aiding postoperative convalescence. In the avoidance of shock following a serious operation it has been a very valuable agent in our hands. The difficulty of preparing the gum acacia is considerable. We have been fortunate in having an English firm at Liverpool, with a New York agency, prepare it very satisfactorily for us and at a reasonable cost.

PROFESSOR E. C. DODDS, LONDON, ENGLAND.—I was interested and surprised to hear that glucose is given preoperatively intravenously to patients as a routine. It would appear difficult to understand the rationale for this when one considers that the majority of patients are capable of taking glucose by mouth. In England I have had considerable experience in treating patients who had diabetic coma, many of whom had been neglected in their earlier treatment before coming to the hospital. In these patients the clinical picture resembles a patient after a severe operation: the pulse is uncountable usually and they present an appearance of "dehydration." Our custom is to give such patients intravenous saline of double strength very slowly. As Dr. Ward has pointed out, the slowness is of the utmost importance. I should like to raise the point as to whether the beneficial effects of the intravenous treatment described by Dr. Polak are due to the fluid given intravenously or to the high glucose content causing water to be retained in the circulation.

With regard to insulin, I think one is on very dangerous ground when employing this for nondiabetic patients. After all, the action of insulin is not understood completely and we are not certain as to the effect it will have upon nondiabetic patients. Again, apart from diabetes mellitus there is no definitely proved disturbance of the internal secretion of the pancreas.

Finally, one would have expected 50 per cent glucose solution to cause severe damage to the vein wall and possibly thrombosis.

DR. CARL H. DAVIS, MILWAUKEE, WIS.—One advantage of the 50 per cent hypertonic solution is that it is given with a glass syringe without the use of rubber tubing. We have found in a careful investigation of so-called glucose reactions that almost invariably it was possible to demonstrate that the rubber tubing had deteriorated. We now only use the rubber tubing on the glucose apparatus a limited number of times because the tube will deteriorate just as rubber gloves do. If you will take and open up the tubing, you will find that the interior of the tube is very brittle.

It is probable that the so-called glucose reactions are after all a foreign body reaction and not due to the glucose solution. I have a feeling that oftentimes glucose has been used to the exclusion of other solutions where it would have been better to use salt solution. I suppose Dr. Polak has a recommendation in his paper for the 3 per cent salt solution with the glucose. We think that is very often better than using the straight glucose. Furthermore, I believe with Dr. Hutchins that the use of the solution with insulin has a definite place in some pregnant cases. The

acetone and diacetic acid disappear more quickly if we use insulin. We have had considerable experience with glucose and insulin and have seen no ill-effects. The hypertonic 50 per cent solution has one great advantage in that you can take it into the patient's home and give it without any special apparatus except a Luer syringe. We believe it has a definite place and have seen no bad results from its use.

DR. COLLIN FOULDROD, PHILADELPHIA, PA.—I am rather amazed that a 50 per cent glucose solution is used. We are told by the neurologist to use the 50 per cent solution for dehydration in many diseases of the brain. It has always seemed that the 50 per cent solution should be reserved for the edematous patients.

We use either a 15 to 25 per cent solution with equally good results and very few reactions when the container and rubber tubes are cleansed first with sterile water.

DR. JOSEPH BRETTAUER, NEW YORK CITY.—I do not intend to discuss glucose, having employed it only in extreme instances. I want, however, to express my surprise that a series of 200 cases of shock are reported as having occurred in a clinic during a comparatively short period of time. Of course shock always has and always will occur in women whose general condition is considerably below par, who must undergo an abdominal operation requiring a longer time than average, and who bleed copiously during operation. In my experience, covering over forty years, such instances have been infrequent. It is my opinion that the average case requires no antishock treatment, either pre- or postoperative.

DR. POLAK (closing).—It has been the routine practice in our clinic for a number of years to use intravenous glucose in every case of infection, in the interval between transfusions. These are given about every four days and on the other days our septic patients receive approximately 75 gm. of glucose a day. We feel that it stimulates the heart muscle and pancreatic action and insulin is not needed, the "spill" in the urine takes care of the excess or overflow.

The preoperative value of glucose was noted in the Obstetric Service. The woman who has been in labor for a long time, sometimes twenty, thirty or forty hours, is a bad operative risk if operation becomes necessary but if she is given preoperative glucose in concentrated solution we find a very definite improvement and the patient who would have been otherwise an extremely grave operative risk under anesthesia shows little disturbance of pulse or pulse pressure.

I think that Professor Dodds missed my point. All of our patients eat sugar before operation, just as we insist that each woman shall take eight to ten glasses of water.

The reason that we use a 50 per cent solution of glucose is, first of all, because of its availability. It was difficult to carry out the detail of the gum-glucose solution of Dr. Farrar as to purity of preparation, temperature, speed, etc., but we found that we could throw 50 per cent hypertonic solution of glucose into the vein with a Luer syringe at a much more rapid rate without reaction, and we have not had reaction in these cases.

As to Dr. Brettauer's remarks, the 200 cases of shock which he criticized represent the work of some of my associates in other hospitals as well as our own hospital, furthermore but few were in the severe class.

As to the question regarding obliterating the vein, it depends very much on the care in injecting the glucose. If one gets into the vein with but little injury to the intima there is no thrombosis. We have carried patients who have received 50 gm. twice a day for a week and have had no obliteration of the vein.

2. **Reconstruction of the Urethra and Vesical Sphincter by Employing the Levator Ani Muscles,** by Dr. Marion Douglass, Cleveland, Ohio. (By invitation.) (See page 739.)

DISCUSSION

DR. REGINALD M. RAWLS, NEW YORK, N. Y.—In 1880 Emmet reported that he had succeeded in six or seven cases in restoring the urethra but also said he felt disposed not to waste his energy on the slim chance of success or permanent benefit from this procedure. In ten years, 1906-1916, at the Woman's Hospital we have had four cases of total destruction of the urethra admitted for repair, and I have operated upon three of these patients. In one I used the technic as suggested by Taussig and transplanted the levator ani muscle. But because of the extent of the injury to the levators, it was impossible to transplant the muscle at a point above the reconstructed urethra. After ten plastic operations I succeeded in restoring the urethra and closing the fistula in the base of the bladder. At the final operation for a small urethral fistula the levators were found transplanted but had retracted, and it was found necessary to resuture them to a higher plane. In my second patient, who disappeared after one operation, I was able to restore about two-thirds of the urethra. In this case I used the method of dissecting flaps from the vagina and suturing them over a catheter without attempting to transplant the levators.

My third case was one which had been caused by the unskillful delivery of a monster and resulted in sepsis, complete laceration of the pelvic floor, complete destruction of the urethra and a vesicovaginal fistula. In this patient by one operation I was able to restore the urethra, relieve the vesicovaginal fistula and restore continence. The technic used was that presented to this Society in 1923 by Ward with the suggestion offered by Farrar at the same meeting. In looking through the index of our Transactions for fifty years I find this the only presentation under the title of reconstruction of the urethra. This method is to dissect free a flap from the vagina and pull it through a submucous tunnel as devised by Kelly, further in suturing this flap into a tube before pulling it through the tunnel as suggested by Farrar, and finally in utilizing the labium minus as a graft to close in the raw area, as suggested by Noble. In addition to the above I also made a more complete tube by suturing it at its base to the lower stab wound just above the fistula. This operation was done in 1924 and is the first time that Farrar's suggestion was adopted. The levator was not transplanted, and we used a Kelly stitch to relieve the incontinence. This patient was followed for over four years. She had perfect control immediately after operation and fair control except under unusual exertion or emotional stress, although about one year following the operation she was delivered of a small premature baby which survived.

It is interesting to note, as Dr. Douglass has shown, that it was not until 1878 that Lawson Tait first used vaginal flaps dissected partially from the underlying tissues to reconstruct the urethra. Also as early as 1863 Baker Brown operated upon a patient, closing the opening into the vagina and then tunnelled under the symphysis to give an outlet for the urine. At the present time it seems that the method of choice is the one of the submucous tunnel lined with a graft from the vagina, as in one of Dr. Douglass' cases, and used also in my third case.

DR. FREDERICK J. TAUSSIG, ST. LOUIS, MO.—I am very glad to see this little operation of mine resurrected. The patient reported in 1918 subsequently became pregnant again and, in spite of the delivery of a normal sized child, the reconstructed urethra held and functioned as well as it did before. That is my only experience with this particular operation. I have never had 100 per cent

satisfactory results with any method. If I succeed in getting the patient comfortable, so that she does not wet the bed at night and is only partially incontinent in the daytime, I am fairly well satisfied.

It seems to me that the important thing is prevention of the condition. There are primarily two groups of patients in whom we have to reconstruct the urethra: first those in whom there are severe lacerations at childbirth; and second, those in whom there is a resection of the urethra for carcinoma. Now, after my unsatisfactory experience in trying to reconstruct a new urethra that will function after removal of the urethra for carcinoma, and since my final results from irradiation have proved so eminently satisfactory, better even than after surgical excision, I prefer in carcinoma of the urethra to use radium locally in combination with radical removal of the tributary lymph glands.

It is very difficult to compare results as to lacerations because each case is different. For instance, a case that has been bothering me for six or seven years is one in which the symphysis was ruptured as well as the urethra. I think in cases of that kind we are dealing with problems that are almost beyond the possibility of complete surgical repair. In this case, with the assistance of an orthopedic surgeon, I transplanted a part of the rectus muscle and fascia, at the same time having the orthopedic surgeon do a plastic on the ruptured symphysis. That operation was only partially successful. Whenever possible, I think the use of the levator muscle is distinctly advantageous and if the lacerations have not gone too deeply and the muscle has not atrophied, its use as described will be a great help in our final result. Personally, the various methods of plastic repair of the canal have not been satisfactory. It has just meant a lengthening of the urethral tube. The results are more satisfactory where we get good muscular support.

One thing I would like to stress. In plastic work about the urethra I always at the same time provide suprapubic drainage. Wound healing is infinitely better.

DR. JOHN O. POLAK, Brooklyn, N. Y.—All who have spoken are experts in plastic surgery, yet they admit that the plastic results are not altogether satisfactory and that a number of these patients leak under strain and excitement. Many cases come to us who have been previously operated upon a number of times and the tissues are so scarred that they are very difficult to handle and mobilization of the bladder or urethra is impossible, hence I do not want this discussion to close without calling your attention to the fact that some of these intractible cases can be relieved of their difficulty by transplantation of the ureters into the colon by the Coffey technic.

DR. CAREY CULBERTSON, Chicago, Ill.—In 1928 I saw my first case of destruction of the urethra. This patient had urinary incontinence for four years following an induced abortion. Not only was the posterior urethra gone but a rosette of vesical mucosa protruded into the vagina. There was no lateral infiltration or extensive scar tissue. The patient had not been operated upon previously and the case appeared to be a simple one. I operated upon her in March, 1928, by the Dudley operation. This did not hold. In May of the same year I decided to take Dr. Taussig's advice, making wide vaginal flaps so that levator musculature could be brought together without tension. This constructed a bridge under the vesical neck that held, and there was no longer any eversion of vesical mucosa. She had some continence after this operation. It was about that time that the operation described by Dr. Douglass was published and I persuaded the patient to permit a third operation. A spade-shaped flap was transposed anteriorly and this held very satisfactorily. I saw the patient last November and she was free from urinary incontinence and had then a urethra about 5 cm. long.

DR. DOUGLASS (closing).—I believe as Dr. Rawls has said, that there is very little question but that the levators separate and pull apart, especially above the urethra, but I believe that their crossing with contraction gives the urethra sufficient support from below to furnish quite good functional results.

I agree with Dr. Taussig that in these cases suprapubic drainage is of great importance, and certainly I believe that I would have obtained better results in so far as the urethra is concerned if I had employed suprapubic drainage and had not left a catheter in the newly constructed canal for such a long time.

3. **Basal Metabolic Rates in Late Pregnancy and the Puerperium,** by Dr. Otto H. Schwarz, St. Louis, Mo. (See October issue, page 571.)

DISCUSSION

DR. EDWARD L. KING, NEW ORLEANS, LA.—I agree with Dr. Schwarz that the contention of Wheeler in regard to the increased metabolism being entirely due to the maternal increase, especially in the tissues, is not well founded. An interesting observation was made in 1926 by two French writers that there should be an increase in the last month of pregnancy as high as 35 per cent. They found that this dropped to about 15 per cent about the eighth day postpartum. I would like to call attention to their note that intrauterine fetal death caused a drop in the metabolic rate. More recently, in the March number, 1931, of the *Journal of the Canadian Medical Association*, Abbott and Ball have reviewed this subject incidentally in connection with other points in thyroid metabolism. They raised the question whether there should be an increase in basal metabolism during pregnancy and state that if there is no increase in the fifth month the possibility of cretinism in the child should be considered. In the South we do not have nearly so high an incidence of goiter as in the northern sections, especially in the region of the Great Lakes.

DR. CARL H. DAVIS, MILWAUKEE.—The problem of thyroid deficiency is a very serious one to those living around the Great Lakes. We are finding in our gynecologic patients, as well as the obstetric patients, that a much greater number of women have hypothyroid conditions than has heretofore been believed.

The interest of the profession over a period of years has been directed almost entirely to the so-called toxic states of the thyroid gland to the extent that we have completely overlooked the fact that while a few patients have toxic conditions, very many more have hypothyroid states. Furthermore, many of these patients get into the hands of surgeons when they are going over from a subnormal thyroid into a very definite hypothyroid state. Many of these women will for a few months have evidences of a toxic condition. Some of these patients are most difficult to handle with the hypothyroidism which follows a thyroid operation because of the fact that they are not then able to take desiccated thyroid. If adequately treated medically, the patients without evidence of adenoma who develop evidence of hyperthyroid conditions, frequently will pass from a very high basal metabolic rate to a minus twenty or thirty within six months and thereafter will definitely require desiccated thyroid.

4. **Prevention and Repair of Hernia in Low Median-Line Incisions,** by Dr. James C. Masson, Rochester, Minn. (See October issue, page 596.)

DISCUSSION

DR. JOHN A. McGLINN, PHILADELPHIA.—In reviewing our hospital work for the past year we found two abdominal incisional hernias, one a right rectus follow-

ing an acute appendix and one a patient on whom I was operating for a large tumor. In reviewing our 2,000 abdominal operations only 5 were for incisional hernia. I believe the factors of lack of drainage and lack of infection play a great part in the elimination of hernia. Another important fact which I think contributes to hernia is that so many operators are apt to turn over the very important function of closing the abdominal incision to the resident physician. This is a very important part of the operation. In my hospital service I either close the incision personally or my first assistant does so but never the resident. A very important factor, of course, in the prevention of hernia is the close and proper approximation of all the tissues.

I cannot subscribe to what Dr. Masson has said about spinal anesthesia as predisposing either to hernia or to pulmonary complications. Of course, it is true that you get pulmonary complications with spinal anesthesia just the same as you sometimes do with inhalation anesthesia, but spinal anesthesia does do several things, to my mind, in the prevention of hernia. First, it gives a better relaxation and therefore necessitates less traction upon the wound; and secondly, the patient rests very much better after operation and there is no straining from vomiting which causes a great increase of intraabdominal pressure. Therefore this form of anesthesia should tend toward the prevention of hernia.

My experience with procain in the few cases in which I have used it has not been very satisfactory for prolonged operations. There is this to be remembered, however, about novocain, that the German preparation is heavier than the cerebrospinal fluid and therefore the patient should be kept in the sitting position for ten minutes before being thrown back, whereas with procain the patient must be thrown back immediately.

DR. HARVEY B. MATTHEWS, Brooklyn, N. Y.—I think that the prevention of incisional hernias is largely a matter of good technic, save perhaps in those very asthenic patients whose healing powers are poor. Even then technic has a great deal to do with perfect healing. So many operators extend the incision beyond the fat and skin and the very end of the incision is difficult to get to unless you are meticulously careful. I make the skin incision longer than the fascia and the fascia longer than the peritoneal incision, so that the peritoneal ends, as well as fascia and fat can be well approximated.

DR. ROBERT L. DICKINSON, New York City.—It is well worth taking up an older procedure, the transverse or Pfannenstiel incision. This is applicable, for instance to laparotomies for the sterilization of the feeble-minded and insane, of which several thousand have been done here in America. In all cases where there is little work to be done inside the abdomen and a small incision will suffice, the transverse incision should be carefully considered. It has certain advantages. Stay sutures are hardly necessary. Hernias are rare because you do not make the longitudinal incision in the fascia and it works on the general principle of gridironing or putting the various layers of the incision at right angles.

It has another advantage, the cosmetic effect. It is hidden in the fold above the mons. The small transverse incision is correct surgery because it follows a natural line of skin. The ordinary incision is one of which the surgeon should be ashamed when it leaves a permanent *telegraph pole scar* showing where the stay sutures went in. If those sutures make exit on the edge of the skin, and are tied around a test tube you avoid this deformity. Avoidance of excess tension on sutures and small abdominal incisions should be considered as important preventions of hernia.

DR. GEORGE GRAY WARD, NEW YORK CITY.—In my clinic at the Woman's Hospital for a great many years the median line incision has been used. Then dissecting the skin and fat off the left rectus sheath, the sheath of the rectus is opened over the center of the belly of the muscle, the edges of the fascia are picked up and the muscle is displaced to one side and the peritoneum is opened up underneath the rectus muscle. Thus when we close the wound we have an intramuscular incision, as the rectus muscle is interposed so that there is no direct wound from the abdominal cavity to the skin. We have had considerable experience with this method over a period of years and in a study made a few years ago we were able to trace only two hernias, both very small, in one of which the wound had been closed by an assistant; the other was in the lower angle and extremely small. It seems to me that this is a very satisfactory method. We always use stay sutures and do not have the telegraph pole deformity because we tie those stay sutures over a roll of gauze.

DR. MASSON (closing).—Dr. McGlinn has mentioned that hernias are not as common as formerly. I agree with him. Many of the cases which I have reported followed operations performed many years ago. I still think, however, that hernias are more common than is generally realized.

Most of the 313 patients referred to in my paper came from various parts of the country; as a rule the previous operation had been done in city hospitals. It is possible that surgeons in the smaller hospitals close most of the wounds themselves and probably with more care than is frequently observed in large, crowded hospitals. As far as the surgeon is concerned spinal anesthesia is an ideal one for any operation, but I want to stress the point that statistics in a large number of cases show that the same types of operations done under properly selected general anesthetics by surgeons who are doing much work will be done with a lower mortality. Spinal anesthesia with the use of nupercaine has the advantage of giving surgical anesthesia for from two to three hours and probably is of advantage when a long operation is contemplated or a relatively slow operator is performing the operation, but I consider it more dangerous than any general anesthetic, local infiltration, regional block or spinal anesthesia, with the use of procaine. I think Dr. McGlinn must have misunderstood me, as I did not mean to infer that spinal anesthesia predisposes in any way to pulmonary complications but they occasionally occur following its use.

Four of the cases of hernia followed the Pfannenstiel type of incision. I have used this type of incision very little. One practically never sees postoperative hernia in a median rectus incision unless there has been infection, but it may occur in the low median-line incision, without preceding infection, particularly in women with a wide diastasis of the recti muscles.

I would like to stress the difference between living sutures and mass transplantation of fascia lata. The latter seldom heals satisfactorily on all sides whereas the living sutures can be counted on to live and remain where placed in most cases. I now advise operation with the use of living sutures in cases in which I did not attempt to operate ten years ago. I had the opportunity of examining the inside of a hernia that I had repaired about six months previously. The second operation was for malignant lesions of the large bowel. I could feel the living sutures which had been placed both vertically and transversely, like the gut of a tennis racket.

I regard the Cameron or Battle type of incision satisfactory for appendectomy, but I have never used it when operating on pelvic lesions. I always feel that I get better exposure with a median-line incision and feel absolutely sure that with proper closure there need not be any fear of hernia.

5. **Regeneration of the Uterine Mucosa After Delivery, With Especial Reference to the Placental Site,** by Dr. J. Whitridge Williams, Baltimore, Md. (See page 664.)

DISCUSSION

DR. WILLIAM B. HENDRY, TORONTO, ONT.—When I heard that I was to discuss this paper of Dr. Williams I did a very unorthodox thing. I had curettings taken from the uteri of 24 women who had been normally confined. These curettings were taken under strictly aseptic precautions, and we took four specimens from each of these uteri, one from the anterior wall, one from the posterior, and the other two laterally. It did not seem to do the patients any harm but we got certain interesting results.

Twenty-four patients were curetted during the puerperium; ten between the fourth and fifth days and fourteen between the ninth and eleventh days. All were multiparae with two exceptions. All had normal spontaneous births with a normal third stage and normal involution of the uterus. Patients with a fever of 99° F. or over were not curetted.

The method was as follows: Patients were draped with sterile towels, vulva cleansed with lysol solution, bivalve speculum inserted and cervix exposed. Lochia discharge wiped away and cervix and vagina cleansed with 1 per cent lysol solution.

When curettings were obtained on the fifth day a large sharp-edged curette was used. On the tenth day a small curette was necessary due to the closing of the internal os. The actual curettage of the uterus caused the patient practically no distress. Pain was experienced on insertion of the speculum and on passage of the curette through the cervix. It varied in intensity according to the dilatation of the cervix and type of patients.

The gross appearance of the curettings was practically the same on the fifth and tenth day. The amount of tissue obtained was always very scant, varying only slightly with different patients. In two patients no tissue was obtained. It was impossible to be sure that the placental site was curetted although in all probability it was. Four strokes were made with the curette, one on the anterior, one on the posterior wall of the uterus and one on each lateral wall.

On microscopic examination of the tissue so obtained between the fourth and fifth day, only one section revealed chorionic villi. The rest showed typical decidual tissue in various stages of degeneration. The cells were swollen, cell boundaries indistinct and the nuclei stained faintly. Many of the nuclei were rather granular while others were homogeneous and pale in appearance. The cytoplasm of the cells which were most degenerated had a pinkish hue. The spongy layer of the decidua showed stromal degeneration while epithelium of the glands presented a frayed irregular appearance and in many areas was absent.

Hemorrhage into the stroma was slight, appeared to be quite recent and probably due to operative trauma. The most constant finding was extensive infiltration of polymorphonuclear leucocytes throughout the stroma. In many cases, particularly when degeneration was most marked, the infiltration was so extensive as to practically obscure the stromal cells. *There was no evident dilatation of capillary vessels and none were thrombosed.*

Curettings obtained on the ninth and tenth days presented an altogether different picture. Endometrium of the nongravid stage was evident and of a hyperplasia pattern. Glands varied in size, were lined by a low cuboidal epithelium with deeply stained nuclei and scant cytoplasm. Stromal cells were small and also deeply stained. Nuclear figures were present both in the stromal and epithelial elements, but were quite infrequent.

Stroma was still infiltrated with polymorphonuclears but to a much less marked degree than on the fifth day.

Decidual cells were still evident but they presented a hyalinized appearance and were only represented in faint outline. Groups of such cells were frequently seen almost completely surrounded by regenerated endometrial stroma. The regenerating epithelium in some areas presented an almost malignant appearance, cells varying in size and staining qualities, with large deeply stained nuclei.

In the first few days postpartum there is a heavy polymorphonuclear infiltration of all remaining decidua. For some reason degeneration is rapid and both stromal and epithelial elements are affected. By the tenth day regeneration has started probably from the base of the decidua or basal layer of the endometrium. Regeneration is rapid and both stromal and epithelium elements overgrow and surround degenerated decidual cells. At this stage evidence of the pregnancy is still present and evidence of regeneration is seen in the hyperplastic pattern of the endometrium and nuclear figures both in stroma and epithelium.

The fact that regeneration is rapid is made evident by the presence of mitoses, large atypical epithelial and stromal cells which have overgrown and surrounded remnants of decidual cells.

DR. EMIL NOVAK, BALTIMORE, MD.—Dr. Williams drew an analogy between the casting off of tissue after delivery and that which occurs with menstruation. As might be expected, the regeneration of the endometrium after pregnancy is considerably slower than that seen after menstruation. If the endometrium is examined, the very day after menstruation, its regeneration is seen to be complete. As a matter of fact, even toward the end of the actual desquamation, and while the latter is still in progress, one can observe the new epithelial surface being restored from the stumps of the uterine glands.

So rapid is this regeneration of the epithelium that one wonders whether it can be due entirely to a proliferation of the epithelium of the utricular gland stumps, especially as one rarely sees mitoses at this time. They are much more abundant in the week following menstruation. It seems not impossible that the new epithelial surface may be formed, in part at least, from a metaplasia of the stroma cells. This is not nearly as heterodoxical as it may seem, for both the epithelium and the stroma are, in the case of the uterus, of mesodermal origin.

It is of interest to speculate as to what happens to the mechanism described by Dr. Williams in cases in which there is an abnormal retention of placental tissue. Profuse uterine bleeding is not infrequently due to the retention of even very small masses of placental tissue, and even alarming bleeding may be noted at the operating table when comparatively small placental polyps are curetted away. It would seem that in such cases there cannot be such an obliteration process of the blood vessels at the placental site as Dr. Williams has described. Whether this latter process is in some way inhibited by the presence of the placental tissue, or whether some extra factor like infection is responsible, is perhaps difficult to determine, and I do not know whether Dr. Williams has had an opportunity of studying cases of such type from this standpoint.

I was also interested in Dr. Hendry's description of the histologic appearance of curettings at periods after delivery, and especially in his statement that a hyperplasia pattern of the glands was at times observed. In our laboratory we have been struck by the not infrequent occurrence of hyperplasia after pregnancy, and this is associated at times with bleeding, so that often there has been a suspicion of retention of gestation products. It would seem that in these cases there is a hangover of the anterior pituitary overactivity characteristic of pregnancy. This point, however, I hope to discuss in my own paper tomorrow.

DR. KARL H. MARTZLOFF, PORTLAND, OREGON.—Dr. Williams' presentation has closed a tremendous hiatus on a subject about which we have long needed to know more. It occurred to me that regenerating endometrial epithelium, with certain exceptions, conducts itself as does the regenerating epithelium of the other hollow viscera which in turn is not so different from the mechanism governing the regeneration of the stratified epithelium of the body surface.

I may have misunderstood Dr. Williams but I thought he said that the uterine endometrium grows into the thrombosed venous sinuses in some of his cases. To me that is a most unusual observation.

DR. WILLIAMS.—You misunderstood me.

DR. MARTZLOFF.—I have seen it grow under a fibrinocellular membrane but have never seen epithelium grow into a blood clot such as I understood Dr. Williams to describe.

DR. JAMES R. GOODALL, MONTREAL, CANADA.—This presentation opens up a new and interesting chapter in uterine physiology. It brings up a question for which I hope Dr. Williams may have a ready solution. It is as follows: the degeneration in the endometrium is similar in every respect to the hyaline degeneration that affects the subplacental vessels postpartum, from the area immediately below the placental attachment right out to the main uterine trunks. We know that this hyaline change is an elastoid degeneration preparatory to absorption. In the uterine musculature this destruction and absorption is more or less complete after some months, but at times traces remain in a fixed state as evidence of the previous parturient history of the woman. Why then is it that the vessels within the uterine wall remain for absorption, whereas that portion of the same vessels within the endometrium is slowly exfoliated as demonstrated today?

DR. WILLIAMS (closing).—Of course, I could not say all I desired in the short time at my disposal, but some of the points brought up in the discussion will be found mentioned in the published paper.

I was very much interested in what Dr. Hendry found in his fresh curettings and especially that he found mitotic figures in many cases. Personally I was not able to find them in my specimens until the end of the second week, but instead I found very extraordinary degenerative changes in the epithelial cells, so that I am inclined to believe that in the first two weeks after labor the bulk of the growth is by direct instead of indirect or mitotic division. I consider Dr. Hendry's contribution to the discussion very valuable.

Dr. Novak asked what happens when portions of villi are retained. I can only speak from the findings in a couple of specimens because I have not had much material along such lines. Some months ago at the request of the psychiatrists I did an abortion on a woman who had homicidal mania. About twelve weeks later it was thought for various reasons that she should be sterilized and accordingly I removed the uterus. It contained a few villi but the placental site twelve weeks after labor had not yet disappeared, and in general corresponded to those in my series at the fourth week. Furthermore, the retention of these villi seemed to give rise to interesting changes, as giant cells were still present beneath the placental site, instead of having disappeared within a week or ten days as usual. So I would say that after abortion certain changes occur which we cannot talk of at the present time because we do not know enough about them, but what happens after abortion with the retention of the fetal elements is a totally different process from the normal regeneration after labor.

Dr. Martzloff was under a misapprehension, because I did not mean to say that endometrial tissue grew from the vessels, but that it grows down between

them. In general, I would say that throughout the entire process there is a great excess of epithelial production and I imagine it is comparable to other processes in Nature, where she is lavish in her repair and overdoes it in many cases.

Dr. Goodall wrote an important monograph in 1910 on the involution of the uterus, and was particularly interested in the arterial changes. I cannot answer his question except to say that we find these changes in vessels throughout the entire uterine wall. Many of them remain for years so that we can diagnose the existence of pregnancy from their presence. We can trace many of these vessels right up to and into the placental site, so I take it that the degenerated vessels which we see in that location represent the terminal ends of vessels further out in the uterine wall. These terminal ends are cast off, but the proximal ends remain. I cannot tell you why that is, but the fundamental reason is rather sound I think and if all this material were left in the placental site, the result would be that each pregnancy would lead to the formation of a huge amount of scar tissue in the endometrium which would completely interfere with its cyclical changes and thus bring to a premature end the reproductive process. The way in which this is brought about I am not prepared to say.

In the paper itself a number of points are dwelt upon which I could not bring out in the few minutes at my disposal, but I wanted to bring before you the idea that the placental site is gotten rid of by a process of exfoliation and that during the puerperium considerable masses of tissue are being thrown off into the uterine cavity, so that the process of exfoliation does not end with the disappearance of the lochia but persists for weeks afterward.

6. **The Length of Labor,** by Drs. J. C. Litzenberg, L. A. Calkins, and E. D. Plass. (Paper read by Dr. Calkins, Kansas City, Kansas.) (See October issue, page 604.)

DISCUSSION

DR. JAMES R. McCORD, ATLANTA, GA.—I have always believed that the length of labor was due to the character of the uterine contractions, the temperament of the patient, the flexion of the head, etc. I have said that labor is longer in the negro, and the perineal floor does not tear as quickly as in the white. This is shown in the statistics from our clinic: In our last 7,192 deliveries we have done 182 forceps and 18 cesarean sections; have had 848 first degree lacerations, 564 second, and 9 third. The average birth weight of the colored baby, not syphilitic, has been found to be six pounds and twelve and one-half ounces.

DR. J. WHITRIDGE WILLIAMS, BALTIMORE, MD.—I was very much interested in this paper, and the figures set before you are very important. My own figures I cannot give, but in a study of my service, labor in colored women was found actually longer than in white women in Baltimore. That is quite contrary to the general belief. Our material shows that their labor is definitely longer. At first glance, it appeared that the prolongation might be due to contracted pelvis, which appears more frequently in the colored than in the white women. We eliminated all such cases, and still found that in normal pelves labor in colored women is longer than in the white. Every comparison that Dr. Peckham has made has been against the black race, as he showed that every complication is worse in the colored, except placenta previa. They have twice as many infections and three times as many deaths even when treated in the same clinic and by the same staff.

Dr. McCord's figures interested me because they come from further south. He says the colored woman has a little smaller baby than the white woman. Our

colored babies are, I think, a little larger than his, but still definitely smaller than the white ones.

DR. ARTHUR H. BILL, CLEVELAND, OHIO.—The length of the second stage in occipitoposterior position is of particular interest. Dr. Calkins showed in the case of women who delivered spontaneously that the second stage of labor was only a few minutes longer when there was a posterior position than when there was an anterior position. I, therefore, conclude that when the head rotated, the second stage was then comparatively little longer than it was in the cases where there was an anterior position originally. I would also judge that the inference was true that in those cases in which the head did not rotate very promptly to an anterior position there was not a spontaneous birth because his series did not include those that were operated upon. Now that would lead me to think that I was justified in claiming that a physician should be able to tell very early in the second stage whether there would be spontaneous rotation, and if not whether there would be an excessively prolonged second stage with the likelihood of there not being a spontaneous birth, as indicated by Dr. Calkins' paper.

DR. HUGO EHRENFEST, ST. LOUIS, MO.—I would like to ask two questions. The first in regard to the old primigravida. A few years ago a Danish or Swedish writer concluded that there was a great difference in regard to labor between the "old primigravida" who was old when she married but became pregnant promptly, and the "old primigravida" who was married many years and grew old before she became pregnant. The women of the first group might have as easy a labor as any primigravida. The woman of the second group is the one with the greater chance of a difficult labor if impregnation was delayed by a cervical, usually inflammatory process, leading to the rigid cervix.

Whenever I deal with an old primigravida, and especially if she has been married a long time, I try to obtain by careful palpation some idea as regards the rigidity of the cervix. I think that these findings have a prognostic value.

As to the second question. Dr. Calkins concludes that the main factor in the duration of labor is the activity of the uterus. A recent paper of a German investigator emphasizes the value of counting uterine contractions. I fully realize the difficulty of such an undertaking, but does Dr. Calkins agree that this all-important factor of uterine activity would statistically best be expressed in the number of uterine contractions required to accomplish expulsion of the child?

DR. CALKINS (closing).—Dr. McCord very properly brought up the point that our figures should not be considered in any way as suggesting a "time limit" for the duration of labor. In our opinion, it will never be possible to set a "time limit" for either the first or second stage of labor. In this paper we were considering averages only and in so doing meant to imply that there was no such thing as a "time limit." The point should have been made more definite.

Dr. Bill inferred that we had discussed only those occiput-posteriors which had rotated anteriorly and then had been delivered spontaneously. A relatively small number rotated posteriorly and delivered spontaneously. A large number rotated anteriorly either late in the first stage or early in the second. The majority did not rotate anteriorly until the head had reached the pelvic floor.

Dr. Ehrenfest brought up several very interesting points. We do not know whether the length of married life before pregnancy occurs has anything to do with the length of the subsequent labor. Dr. Ehrenfest very properly brought out the fact that the consistency of the cervix is an important factor in determining the length of the first stage. We cannot quite agree with him that the number of uterine contractions is as important as the intensity of the individual contraction.

(To be continued in December.)

NEW YORK OBSTETRICAL SOCIETY

MEETING OF FEBRUARY 10, 1931

DR. FRANK R. SMITH (by invitation) read a paper entitled **The Significance of Incomplete Fusion of the Müllerian Ducts in Pregnancy and Parturition, With a Report on 35 Cases.** (For original article, see page 714.)

DISCUSSION

DR. HERMANN GRAD.—I have encountered two cases of double uterus and in each the patient has had four children from the right uterus. In the last case that I had I operated upon the patient for acute appendicitis. I knew before the operation that she had a double uterus from the vaginal examination, but on going into her obstetric history I found she was not at all aware of her condition. She had a double uterus, a double vagina, two cervices, with a very well-developed ovary on the right side, while that on the left side was sclerotic. The other case was one in which there was a suspicion of cancer of the cervix, but this was proved not to be so. I operated for a fibroid of the uterus and there, too, she was not aware of the condition.

I have had one experience with double uterus during labor. In that case the abdomen was never opened, but there the patient had a double vagina and a double cervix, and the cervix on the nonpregnant side caused considerable obstruction in delivering the baby.

DR. ELIOT BISHOP.—In a case of inevitable miscarriage at about five months, the fetus and placenta were expressed, but the patient bled profusely and was rapidly packed. In a day or so the packing was removed. She had a normal convalescence, except that she continued to discharge a black, tarry material for some time. A double uterus was found.

The practical reason for this report that I would like to bring out is: she must have had some *decidual* contents in the *other* part of her uterus which was the cause of the continued discharge.

DR. REGINALD M. RAWLS.—I had one case of uterus didelphys in which the vaginal septum was removed at the age of sixteen. While under my observation she was pregnant twice, each time in the right uterus. The cervix of the right side was almost in the midline, whereas the cervix on the left side was in a culdesac. In each pregnancy the right uterus enlarged regularly and the left uterus only slightly. The first time she went to four months. The second pregnancy was full term and she was delivered normally. The left uterus did not give any trouble at all.

DR. SMITH (closing).—In regard to a question as to whether there were other associated deformities, there were none noted in any of these cases. Dr. William P. Graves has pointed out that one reason why we see so few cases of complete lack of fusion, that is, the uterus didelphys, is that the condition in the living individual is so frequently associated with other deformities of the pelvis which are incompatible with life. As a matter of fact, I was looking for other deformities associated with this, but was unable to find them in any single case.

DR. GEORGE W. CORNER (by invitation) presented a paper entitled **The Function of the Corpus Luteum.** This consisted of a review of recent work in the field of corpus luteum physiology, including the work of Hisaw, Corner, E. Allen, W. M. Allen, Hartman, and others. The further work now in progress will be published at a later date.

NEW YORK OBSTETRICAL SOCIETY

MEETING OF MARCH 10, 1931

DR. F. C. HOLDEN reported a case of **Adenomyoma of the Uterus,** which occurred in a young girl.

B. S., age fourteen years, single, high school student. Bowels regular. Weight 121 pounds eight months ago; loss of 13 pounds since onset of present illness. Menstruation began one year ago, interval twenty-eight days, duration four to five days, amount of flow moderate, no pain at all for first six periods. At end of the January, 1930, period, she had excruciating pain in left lower quadrant for one week postmenstrual (had 3 hypodermics in one day). February period was normal. She had similar and equally severe attacks of postmenstrual pain in left lower quadrant, lasting seven to ten days after her March, April, June, and September periods. With the period of October 14, 1930, for the first time, the severe pain came at the onset and persisted with no relief. When the patient was seen October 23, 1930, she had been in bed for two weeks and had had innumerable hypodermics of pantopon for pain. There was no fever at any time. X-ray and urine examinations were negative and blood count normal.

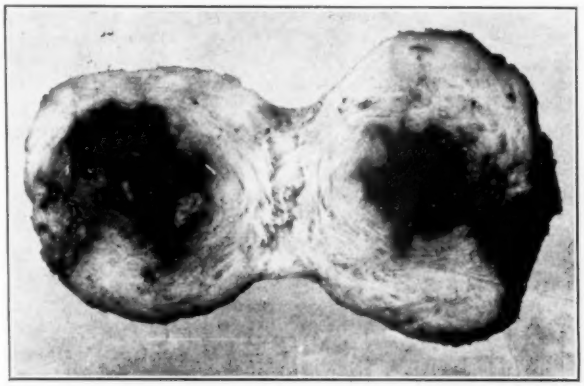

Fig. 1.—Fibroid nodule, bisected, showing central cavity containing old blood.

Examination.—General appearance, well-developed young girl of fourteen years, apparently in considerable pain, walking with a limp to keep her weight off of the left leg. Abdominal tenderness on pressure over left lower quadrant. Hymen intact, normal virginal introitus. Rectovaginal: Small cervix pointing forward and to the right, uterus retroflexed, definitely enlarged, hard, regular in contour, lying over to the left, not adherent, exquisitely tender. No adnexal masses made out.

Preoperative Diagnosis.—Retroversion of uterus with possible dermoid of left ovary.

Operation.—On November 5, 1930, the patient was operated upon under gas-oxygen-ether. Through a left rectus incision, the fundus was found retroverted and to the left. Both tubes and ovaries were found to be normal. The fundus was brought into view and on first impression it seemed to be a bicornuate uterus. On more thorough investigation, a fibroid nodule was found in the left half of an otherwise normal uterus, was dissected out, and the uterine wall was then closed in two layers. The uterine cavity was not entered. Following a one point suspen-

sion of the uterus, the abdomen was closed. The patient had a smooth convalescence and was discharged two weeks later.

The nodule (Fig. 1) was firm, symmetrically round, 2½ inches in diameter. The gross appearance was that of a fibroid. Upon section (Fig. 2), there was found directly in the center, a circular cavity, 1 inch in diameter, filled with a small amount of old black blood. The lining of this cavity was very smooth, being identical in gross appearance with that of uterine endometrium (Fig. 3). There was no connection between the central cavity and the uterine cavity.

Fig. 2.—Low power, section through central cavity showing its lining to be well-developed normal uterine endometrium.

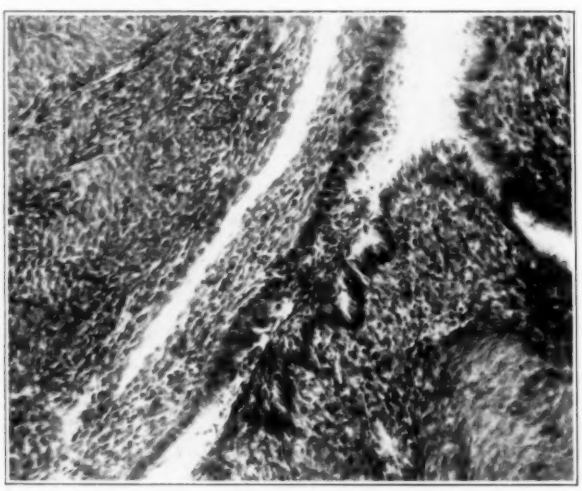

Fig. 3.—High power, same as Fig. 2.

Comment.—The case is unusual due to the age of the patient—the occurrence of such a fibroid at the age of fourteen years, only six months after the onset of menstruation. The possibilities as to its origin are equally interesting. It was not a direct extension from the uterine mucosa as we saw at the time of operation. Metastases of uterine mucosa from the uterus with development of a fibroid about it is equally improbable, as it would not have reached that size and develop-

ment in such a short period of time. The third possibility that it was of developmental origin, is the most likely, namely, that it was an aborted development of a double uterus, the second uterus remaining as a miniature uterine cavity without any outlet, surrounded by its musculature, the whole remaining as a fibroid nodule in the normal uterine wall. With each period, the menstrual flow of this enclosed uterine cavity accumulated, causing increasing dysmenorrhea. Since the operation, four and one-half months ago, the patient has had normal painless menstrual periods.

DR. RANSOM S. HOOKER (by invitation) presented a preliminary report of the Joint Committee for the Study of Maternal Mortality in New York City, in which he described the plan of the investigation and the tentative results of the Committee's work for the first of the three years which the study will require. At the end of this period a full report will be published in the JOURNAL.

DISCUSSION AND COMMENT

DR. GEORGE W. KOSMAK.—The New York Obstetrical Society is to be congratulated on the very successful outcome of the work which they really initiated by formal resolution a little over a year ago and upon the fact that the services of a man have been secured who has been able to give his full time to this investigation. Dr. Hooker found it necessary to revise to a large extent the methods which had been employed heretofore in developing a similar series of statistics, and I believe that this is going to be the most noteworthy study of its kind which has been made in this country, because these puerperal deaths are investigated in a week or ten days after they occur when the facts in relation to them are still fresh in the minds of the attendants.

It has been very satisfactory to note the cooperation which the Committee has obtained throughout the city of New York.

As I sat here I heard a number of remarks from those about me with regard to the startling character of the figures. As a member of the Committee which has gone over these figures month by month I can echo that expression—they are very startling, and the question is: Where shall the responsibility be placed for these startling figures?

The propaganda which has been put out in past years by the Children's Bureau and other organizations with reference to the position that the United States occupies in the list of civilized countries in its puerperal mortality statistics, is something that we can disregard to a certain extent because these statistics have not been based on similar grounds. Notwithstanding the probably exaggerated character of the figures that have been brought forward for special reasons, I think we must admit that the death rate from puerperal causes in this country is much too high, and that this as well as other studies will show as time goes on that very many of these deaths are preventable.

Now, please do not accept these figures as final; this is just a tentative statement of the first year's work, but the members of the Committee felt that the results that have been obtained thus far should be placed before you. Moreover we have been very much gratified to note the support which other cities have given this movement, and will undertake similar studies. So I feel that at the end of another five-year period we will get some real knowledge as to the actual causes for puerperal deaths in this country, and then we will be able to formulate our recommendations for improvement on a substantial basis.

DR. H. C. WILLIAMSON presented a paper entitled **A Simple Technic for Cesarean Section Under Local Infiltration Anesthesia.** (For original article, see page 761.)

DISCUSSION

DR. A. C. BECK.—We have done quite a number of operations under local anesthesia. I do not think it is necessary to anesthetize the visceral peritoneum. If we do a classical section we do not anesthetize the uterus at all and are able to suture the uterus without any difficulty whatsoever. It is not necessary to give gas under those circumstances. In doing a low section, however, it does hurt the patient without a general anesthetic, while removing the baby.

There was one point in the technic that seemed rather unusual, namely, giving of pituitrin before the birth of the child. Formerly, when we did the classical operation, we always gave pituitrin before the uterus was incised, but we discontinued that when we took up the low technic as we found that it seemed to increase the difficulty in the extraction of the child.

DR. WILLIAMSON (closing).—The case illustrated in my film bled more than is usual when a patient is operated upon by this technic. I do not know just why there is less bleeding under local anesthesia. I had occasion to operate upon one patient with central placenta previa, who was practically exsanguinated on her arrival at Bellevue Hospital. She was given saline by hypodermoclysis, gum glucose solution intravenously and a transfusion. The operation was uneventful and with only a small blood loss. It is for this type of patient that local anesthesia is most useful.

In regard to the visceral peritoneum which we infiltrate; I do not think it very sensitive, but the large wheal that is raised makes dissection of the flap very easy.

I gave the pituitrin extract a little too early in one patient and had difficulty extracting the baby. Ordinarily, however, this does not occur.

DR. S. A. COSGROVE read a paper entitled **Nupercaine Subdurally in Obstetrics.** (For original article, see page 763.)

DISCUSSION

DR. GEORGE W. KOSMAK.—In the records of the Committee for the Study of Maternal Mortality, a considerable number of deaths were noted in patients who had had a spinal anesthetic. I would like to ask Dr. Cosgrove if he has any information as to that subject, or whether he assumes these deaths were due to the anesthesia, or that the anesthetic was a contributing factor.

DR. COSGROVE (closing).—As I have just said, we have had a series of nearly 1,800 cases on our service without any deaths, and I am permitted to quote the experience of my colleague, Dr. Miner, who has used it in nearly 2,000 cases for general surgery with no deaths. My own impression is that where death was attributed to spinal anesthesia it was either due to gross errors in technic, or attributed to the anesthetic unjustly. In a recent paper by Dr. Koster, of Brooklyn, in the *American Journal of Surgery*, he goes into quite an extensive analysis of the reported causes of death from spinal anesthesia and most of them can be discounted as having been unjustly attributed to the anesthetic agent.

Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

Collective Review

The Interrelationship of the Anterior Hypophysis and the Ovaries

2. Further Advances (June, 1929—June, 1931)

BY C. F. FLUHMANN, M.D., SAN FRANCISCO, CALIF.

(From the Department of Obstetrics and Gynecology, Stanford University School of Medicine)

IN A PREVIOUS contribution (Fluhmann[59]), a review of the literature concerning the most outstanding recent advances in our knowledge of the physiology and pathology of the anterior hypophysis in its relation to the female genital organs, was given. Although only two years have elapsed the subject has engaged the attention of such an army of investigators and has resulted in the publication of such a large number of reports, as to warrant a second review covering the main achievements of this short period.

As progress is made in unravelling the mysteries of the so-called "sex hormones," one is astounded at the complexity of problems which have arisen in this connection, and in order to simplify this review it has seemed particularly desirable to indicate the trend of modern research on this subject rather than to attempt the presentation of a detailed list of all the contributions that have been made. For these reasons a number of references have been omitted, and the subject is considered under various subheadings, namely, (1) terminology, (2) the ovary-stimulating factors of the anterior hypophysis, (3) ovary-stimulating substances from extrahypophyseal sources, (4) the stimulation or inhibition of the anterior hypophysis by ovarian hormones, (5) the Aschheim-Zondek pregnancy test, (6) anterior pituitary hormone tests in nonpregnant conditions, and (7) the use of ovary-stimulating substances for therapeutic purposes.

Although such work lies beyond the scope of this cursory review, attention must be directed to important contributions which have recently been made regarding the anterior hypophysis-thyroid interrelationship (Smith, Loeb, Wiesner, Crew, and others), as well as the notable advances in our knowledge of the second ovarian, or corpus luteum, hormone (Corner, W. Allen, Clauberg, Kraus, and others). These studies are inevitably closely allied with the subjects of this review.

1. TERMINOLOGY

It is certainly to be hoped that students in the field of the anterior hypophyseal sex factors will be spared the confusion that has arisen in regard to the terminology of the ovarian follicular hormone, which

is now known under an appalling multiplicity of names. For the purposes of this review, a modification of the terms suggested by Zondek has been adopted since they are very simple and lend themselves readily to abbreviation. The two ovary-stimulating anterior hypophyseal factors are referred to as (1) the "*Anterior-Pituitary-Hormone-A*" (abbreviation APH-A), the follicle-ripening factor, also at times named the "maturity-provoking hormone," and (2) the "*Anterior-Pituitary-Hormone-B*" (abbreviation APH-B), the luteinization hormone. The reactions to the Aschheim-Zondek test are given as Anterior Pituitary Reactions I, II, and III, that is APR I refers to the induction of follicle ripening, APR II to the production of hemorrhagic cysts, and APR III to the formation of luteinized cysts or abnormal corpora lutea with imprisoned ova, in the ovaries of the immature test mouse or rat. The terms *Prolan*, *Prehormone*, and *Emmenin* refer to definite preparations of ovary-stimulating substances, and lead to confusion when they are employed as synonymous with "anterior pituitary hormone." The two ovarian hormones are listed as (1) *estrin*, otherwise known as "the female sex hormone," the estrous-producing hormone, ovarian follicular hormone, theelin, menformon, folliculin, and numerous others, and (2) *progestin*, the name given by Corner to a specific product of the corpus luteum, and which is called *lutin* by Zondek and a number of German investigators.

2. THE OVARY-STIMULATING FACTORS OF THE ANTERIOR HYPOPHYSIS

Since it has been definitely established that the anterior lobe manufactures a substance capable of stimulating follicle growth, it is of importance to determine if there is actually a second hormone which can induce lutein-cell formation. Although this point has not been conclusively demonstrated, it is generally accepted as a fact, and additional confirmation has been brought forward. Wiesner and Crew[160] maintain that the anterior lobe has two very definite "gonadotropic" influences, an estrogenic and a kyogenic. The former effect is obtained when tissue implants or acid extracts are employed and is manifested by the development of graafian follicles in the ovaries and cornification in the vaginal mucosa of the immature mouse, while the kyogenic effect is found when alkaline extracts are employed and is demonstrated by luteinization in the ovaries and mucification in the vaginal mucosa. Wiesner and Crew have also shown experimentally that these results are not due to different concentrations of the extracts, and consequently assume that the anterior lobe manufactures two different substances. Claus[19, 20] has found that an acid extract of desiccated anterior pituitary lobe may be subdivided into two parts, one of which is not soluble in absolute alcohol and yields APR I in immature mice, whereas the second fraction (soluble in absolute alcohol) gives rise to luteinization (APR III). Evans and Simpson[47] have pointed to the importance of the intraperitoneal administration of extracts to rats in order to detect traces of the luteinization hormone, and believe this finding supports the assumption that there are two anterior lobe sex hormones. Fevold, Hisaw, and Leonard[58] have recently reported a method by which they have succeeded in extracting and separating two gonad-stimulating hormones from anterior lobe tissue. They have found that one of these stimulates follicular growth, and the second causes luteinization. It is of especial interest that the luteinizing hormone they have isolated does not act on the

immature ovary unless the ovary has previously been stimulated to follicular activity by the first extract.

The question as to whether the changes set up in the ovaries of immature mice by the anterior lobe can really be considered as a true "maturity-provoking" effect has again been brought up by Mahnert.[109] He has been unable to induce pregnancy in such animals and therefore maintains that ova capable of fertilization are not produced. Fels[56] has shown that following Prolan administration to immature mice the ovaries are only necessary for thirty hours in order to obtain a cornification of the vaginal mucosa. Loeser[106] induced ovulation in pregnant rabbits by injections of a powdered anterior pituitary extract, and Wolfe[161] by a saline suspension of fresh anterior lobe tissue. Engle[43] has demonstrated the importance of anterior lobe implants in the successful grafting of ovaries from immature female rats into normal adult and castrated male rats. He feels that the actions of the sex hormones are not antagonistic, but act selectively on tissues which normally respond to their stimulus. Hartman[72] was able to induce menstruation in a monkey by means of pituitary implants from pigs, and also observed a growth of numerous graafian follicles. Emanuel[42] has corroborated the finding of Engle, and Evans and Simpson that implants of anterior hypophyseal tissue from spayed rats are more potent in inducing ovarian changes than those from normal animals. From two sources have come methods of extracting a luteinizing hormone from the anterior lobe which is separate from the growth hormone (Bugbee, et al.[12]; Reiss, et al[136]). Goss and Cole[70] have analyzed some of the chemical properties of the ovary-stimulating principle found in the blood serum of mares. Burns[14] has studied the effects of hypophyseal hormones upon amblystoma larvae.

In an analysis of disorders of sex in 367 cases of hypophyseal adenomas, Henderson[83] found that the sexual dysfunction occurs only when the sella turcica has become considerably expanded, so that he believes it is due solely to the compression of the basophile cells by the space-occupying lesion. Novak and Koff[122] have described the occurrence of the characteristic pregnancy changes in the anterior hypophysis in patients with chorionepithelioma. Neumann[121] believes that ovarian changes in the way of follicle ripening in newborn girls are due to the gonad-stimulating hormones found in the circulation during pregnancy. Borak and Windholz[9] found fully developed castration changes in the hypophysis of a thirty-year-old woman who had had an extensive pelvic irradiation with resultant atrophy of the ovarian follicular apparatus. Hofbauer[89] found that the administration of anterior pituitary alkaline extracts or implants to guinea pigs results in the formation of numerous follicles in the ovaries and a hyperplasia of the uterine epithelium. He believes that this is evidence for the etiology of hyperplasia of the endometrium in the human, but objection to this conception has been raised by Frankl,[66] and Fluhmann.[63] Hofbauer[87, 88] has also found abnormal epithelial formations in the cervix uteri of guinea pigs following the administration of anterior lobe substances and believes that these have an important bearing on the etiology of epidermidalization, leucoplakia, and carcinoma. However, Hartmann and Olbers[75] have pointed out that these abnormal epithelial changes may occur at certain stages of the normal estrual cycle in guinea pigs, and if so their relation to pathologic conditions is not so clear.

In one of the most important contributions that have appeared during the period under consideration, Smith[145] has given the technic of his operation for removing the hypophysis of the rat, and has analyzed its consequences as well as the reparative effects of replacement therapy. Smith and MacDowell[147] have described an hereditary anterior pituitary deficiency in the mouse, and "by daily transplants of fresh rat pituitaries, the small size, sterility, and associated endocrine abnormalities of an hereditary dwarfism carried by a strain of silver mice have been corrected, with the outstanding exception of the deficiency in the anterior lobe of the pituitary." Smith and Dortzbach[146] studied the sex hormone content of the pig fetus and found demonstrable quantities in fetus of 17 to 18 cm. crown-rump length. The interest of this observation lies in the fact that this just precedes the stage at which Bascom and Osterud[5] found that a rapid growth of the testis begins.

In their original study, Smith and Engle had shown the effects of the protracted administration of anterior lobe implants in mature rats and mice. Confirmation of their findings has been advanced by Siegmund[144] who found that if APH is given in small amounts to mature mice there is a resultant lengthening of the period of estrus, but in large amounts the animals become sterile and the ovaries show a "small cystic degeneration." Nelson[120] was able to induce estrual changes in 8 adult female rats which had remained in a state of anestrus for a period of some weeks. Marrian and Parkes[112] have shown that the use of a vitamin-B deficiency diet in rats causes a permanent anestrus, but that the administration of APH during the experimental anestrus results in ovulation and in the immediate appearance of estrual changes in the accessory organs. This work was confirmed by Evans and Simpson,[48] who also found that the hypophyses of rats given a diet deficient in the antineuritic vitamin B have a diminished potency to stimulate follicle ripening. The anestrus of such animals is thus apparently due to a deficiency of the anterior hypophysis resulting from the dietary condition.

Ovulation in the rabbit normally occurs within twelve hours after copulation, but Fee and Parkes[53] have shown that ovulation does not take place if a hypophysectomy is performed within one hour after copulation. On the other hand, if the operation is delayed for over an hour ovulation occurs, thus suggesting that the hypophysis is essential for ovulation, but only for a short period of time. This conception was further strengthened by Hill and Parkes[84, 85] who induced ovulation in rabbits (hypophysectomized soon after copulation), by administering ovary-stimulating placental extracts. Deanesby, Fee and Parkes[29] have studied the corpora lutea resulting in rabbits hypophysectomized over one hour after copulation, and could find no essential difference from the normal in the development of this structure. They warn, however, against assuming from this observation that the anterior lobe is not essential for corpus luteum formation.

In an attempt to determine which cells of the anterior lobe are concerned with the production of the various hormones, Philipp[129] has conducted extensive implantation experiments with human material at different age periods. He believes that the eosinophiles are probably concerned with the production of APH-A, but that it is questionable whether the basophiles are involved in the luteinization effect. Haterius and Charipper[76, 77] have made histologic studies of the an-

terior pituitary lobe of mice, both male and female, following the continuous administration of anterior pituitary substance, and note the presence of characteristic "pregnancy cells." The same authors[18] believe they have demonstrated a histologic rhythmicity of the anterior lobe during the estrous cycle, the diestrous phase being characterized by a predominance of eosinophilic cells and late estrus by the presence of basophiles with only an occasional poorly staining eosinophile.

3. OVARY-STIMULATING SUBSTANCES FROM EXTRAHYPOPHYSEAL SOURCES

In one of the early studies on the test for APH, Aschheim and Zondek reported the presence of a similar substance or substances in the placenta, blood, urine, decidua, and amniotic fluid from pregnant women, while recently the same finding has been reported for colostrum and milk (Heim[81]), and also (during pregnancy) for saliva (Trancu-Rainer[153]) and the serum in blisters resulting from the application of cantharides (Heim[82]). These observations are of great physiologic interest and have raised many questions regarding the exact relationship between the ovary-stimulating substances present in these tissues and those of the anterior hypophysis.

The discovery that the human placenta has ovary-stimulating properties has been corroborated by numerous observers (Klein,[97] Philipp,[126] Siegert and Schmidt-Neumann,[143] Mirskaia,[116] Centanni[17]), and Wiesner[35] has obtained two extracts, one corresponding essentially to APH-A and the other to APH-B. Collip,[22, 23, 24, 25, 26] in addition to estrin, has obtained two distinct preparations from the placenta, one of which he names Emmenin, while the second is referred to as the "anterior-pituitary-like" extract. Emmenin is estrogenic, probably through stimulation of the intact ovary, and it is active when administered orally. It does not interfere with the estrous cycles of normal adult rats. The "anterior-pituitary-like" extract is also estrogenic, but in addition it stimulates the development of corpora lutea which are normal in appearance. It is not effective when given by mouth, and while it does not interfere with cycles in normal adults, continuous administration results in the appearance of normal cycles in immature rats.

A group of workers (Philipp[125, 126, 127, 128, 130]; Collip[22, 23, 24, 25, 26]; Fels,[57] Motta,[119] and others) have advanced the theory that the placenta manufactures ovary-stimulating substances and does not merely store a product of the anterior hypophysis. The main proponents of this conception are Philipp, and Collip, and the problem has assumed major importance since it is directly concerned with the large amounts of APH found in the blood and urine during pregnancy. The chief arguments in favor of the "placental origin theory" are: (1) The placenta contains very large amounts of an ovary-stimulating substance (or substances); (2) the characteristic histologic pregnancy changes in the anterior pituitary gland of women do not appear until the fifth month of gestation although large amounts of APH are found very early in the blood and urine; (3) the Aschheim-Zondek test is positive in cases of hydatidiform mole and chorionepithelioma, and becomes negative following the removal of the tumor growth; (4) implants of the anterior lobe from human donors, whether male or female, old or young, are always positive for APH, but *negative results are obtained with implants from pregnant women* (Philipp[126, 127]; cor-

roborated by Ehrhardt and Mayes,[41] Zondek,[171] and others); (5) a number of observations by Collip[24] as a result of his researches with Emmenin, namely, (a) this extract is effective when given orally, whereas anterior lobe substance apparently is not, (b) extracts prepared from anterior lobes by the use of acetone, as in the case of Emmenin, have been found to be non-estrogenic in character, and (c) the prolonged treatment of normal adult rats with large doses of Emmenin has not resulted in any noticeable effect upon the cycles or upon impregnation or lactation.

It must be acknowledged that although some of the arguments advanced are impressive, they cannot possibly be accepted as conclusive, and Zondek[171] has recently stated many of the chief objections:

(1) Hypophysectomy in pregnant animals always results in abortion; (2) the diminished amounts of ovary-stimulating substances in the anterior lobe of pregnant women does not mean a lowered production on the part of this gland, but an increase in its utilization by the body so that none remains stored up in the hypophysis. Zondek points to an appropriate simile with Graves' disease where there is an hormonal overproduction on the part of the thyroid but the gland itself contains less thyroxin and less iodine than in normal conditions; (3) in patients with genital carcinoma Zondek finds large amounts of APH-A excreted in the urine, and here as in pregnancy the anterior hypophysis contains *less* APH than normally; (4) in pregnant cows and pigs there is no APH demonstrable in the blood or urine, and since there is apparently not the same call for large amounts of this substance as there is in the human being, the anterior lobe of these animals shows a normal content of APH in the hypophysis. (This finding in the cow had been reported by Evans and Simpson,[45] while Bacon[4] found a lessened hormone content); (5) the presence of these substances in the placenta is not evidence that they are manufactured in that organ. (In one patient Zondek found larger quantities of APH-A and B in the walls and contents of an ovarian cyst than in the placenta of the same patient, and it does not seem possible that they were formed in the cyst); (6) the large amount of APH in the urine appears so early in pregnancy that it is questionable whether the placenta has sufficiently developed at that stage to produce such quantities.

It would seem that the final proof must come from further studies with hypophysectomy in pregnant animals, and it would be essential to obtain evidence such as there is for the placental production of estrin. In this case it has been possible to demonstrate that a bilateral oophorectomy may be performed in the human being without any disturbance in the course of gestation or the continued production of the hormone (Waldstein,[157] Szarka[152]).

In the meantime a considerable amount of attention has been directed toward determining the biologic characteristics of the sex hormones found in the urine of pregnant women. Friedman[67, 68] and later Wolfe[161] showed that the intravenous injection of pregnancy urine rapidly stimulates ovulation in the adult female rabbit, and this observation has been used to develop a new diagnostic procedure. Jares[90] has noted that this finding in the rabbit does not apply to the guinea pig, and Kelly[95] was able to induce abortion in guinea pigs by the administration of pregnancy urine. On the other hand, Katzman, Levin and Doisy[94, 104] by means of a luteinizing extract made from

this source were able to produce an inhibition of estrus in normal adult rats, and during pregnancy a prolongation of the gestation period. Dingemanse and de Jongh[32] have advanced additional evidence that there are two ovary-stimulating hormones present in the urine, and Büngeler and Ehrhardt[13] in a series of experiments based on Warburg's studies found that the injection of pregnancy urine into immature mice results in a change in the metabolism of the uterus which quickly leads to growth of that organ. Borst and Gostimirović[10] found that prolonged treatment with urine from cancer patients, which contains mainly APH-A, results in marked follicle atresia. In a noteworthy contribution, Dickens[31] has given a method of preparation and decribed various chemical properties of the gonad-stimulating hormone from the urine of pregnancy.

Of great importance are the attempts which have been made to discover the exact relationship between the ovary-stimulating principles of the anterior hypophysis and those found in the urine during pregnancy. Engle[44] has compared the effects in the immature mouse of injections of urine from pregnant women and of daily transplantations of anterior lobe, and stated "it is difficult to consider the two types of response as being due to the same factor from the anterior lobe." Wallen-Lawrence and van Dyke[158] believe that the weight of evidence indicates that the gonad-stimulating substance of pregnancy urine is extrahypophyseal in origin. Reiss, Selye and Balint[137] have found a difference in the results obtained from the injection of a luteinizing extract of the anterior hypophysis[136] and those from the injection of the hormones of pregnancy urine. The extract produces corpora lutea, but no marked hypertrophy of the uterus and ovaries such as results from the administration of the urine. Papanicolaou[124] has studied certain vascular phenomena resulting from the injection of urine from pregnant cows into immature guinea pigs, and on the basis of his finding, he questions the existence of any specific hormone primarily affecting the sex glands and causing a luteinization of ovarian follicles. And finally, an important contribution has recently been made by Reichert, et al.,[134] who reported on the ineffectiveness of prolan to induce ovarian changes in hypophysectomized dogs and rats. (This finding is in startling contrast to the efficacy of anterior hypophyseal implants in the hypophysectomized rats of Smith, and the dogs of Reichert.) However, Evans, et al.,[49] also find that gonadal stimulation in hypophysectomized animals may be obtained with prolan when it is given along with an extract of the hypophyseal growth hormone. For this reason, they advance the theory that prolan should be considered as an "activator" which either converts an inactive prohormone in the hypophysis to an active form or else is able actually to convert the growth-stimulating into the gonad-stimulating hormone.

4. THE STIMULATION OR INHIBITION OF THE ANTERIOR HYPOPHYSIS BY OVARIAN HORMONES

This aspect of the problem is as yet obscure but should be considered as of vital importance, as its solution may offer a ready explanation for a number of features directly concerned with the estrual or menstrual cycles. The work of the past two years has been directed chiefly along three lines of inquiry. (1) Changes observed following the administration of ovarian preparations. (2) Effects of simultane-

ous injections of anterior hypophyseal and ovarian substances, and (3) studies in hypophysectomized animals.

On the basis of observations made following the injection of estrin into male rats, Moore and Price[118] believe that estrin suppresses the hypophysis, making unavailable the secretion necessary for gonadal function. V. Bisceglie[7] has reported that the prolonged administration of follicular fluid can produce histologic changes in the anterior lobe of the guinea pig, as manifested by a hyperemia, an increase in acidophilic cells and colloid material, and a disappearance of basophilic cells. Kunde, et al.,[99, 100] stated that estrin injections in a dog resulted in a lessening in the size of the anterior lobe of the hypophysis with a diminution in the amount of cytoplasm in the chromophobe cells. Kraul[101] has observed the effects of implants of the hypophysis from animals previously given endocrine substances from the ovary or placenta, and noted that these implants were more potent to produce abnormal luteinization than those from untreated animals. Meyer, Leonard, et al.,[115, 103] found that the administration of estrin to rats decreases the gonad-stimulating power of the hypophysis, while Spencer, et al.,[148] have observed a small but significant lessening of the growth rate of young rats given estrin, thus suggesting a diminution in the production of the growth hormone. Wade and Doisy[155] also found that 27 of 36 immature rats given theelin or theelol gained less in body weight than their controls. On the other hand, Fluhmann and Kulchar[64] have found that a prolonged administration of estrin to spayed rats does not prevent the formation of numerous "castration cells," and more recently a similar result has been reported by Zondek and Berblinger.[172]

It had been suggested previously by Siegmund and Mahnert that estrin can inhibit the ovary-stimulating properties of the anterior lobe when they are injected simultaneously, and further evidence has been advanced by Dahlberg and Akesson,[28] and Dahlberg.[27] Zondek[170] could not corroborate these observations, but other evidence in favor of this conception has been advanced by Kallas.[92] This observer found that if he united in parabiosis a castrate with a normal animal the latter showed the stimulating effects of the anterior hypophysis due to the excessive production or nonutilization of the sex hormone by the spayed partner. If, however, the castrate is given estrin these effects are not produced in the normal partner, thus pointing to an inhibitory effect on the anterior lobe. On the other hand, Mahnert[110] and Haupstein[79, 80] believe that it is a corpus luteum hormone rather than estrin which offers antagonism to the anterior hypophyseal sex hormone.

Hartman, Firor and Geiling[73, 74] have reported a series of experiments which, if confirmed, will alter many of our present conceptions regarding the menstrual cycle. They have found that estrin does not produce uterine bleeding in hypophysectomized monkeys as it does in the castrate, and conclude that this hormone acts through the hypophysis and not directly upon the genital tract as it is now generally accepted. In addition, they have observed that uterine bleeding can be produced by the administration of anterior lobe hormone in both castrated and hypophysectomized monkeys.

5. THE ASCHHEIM-ZONDEK PREGNANCY TEST

The Aschheim-Zondek procedure for the diagnosis of pregnancy has apparently received world-wide approbation. Aschheim[2] has pub-

lished a valuable monograph dealing with the technic and results of the test, while many articles report satisfactory results from numerous clinics (Wahl,[156] Kaplan,[93] Joffick,[91] Vogt,[154] Pistuddi,[131] Evans and Simpson,[46] Kiselev,[96] Aschheim,[3] Hannan,[71] v. Probstner,[133] Liese and Auer,[105] Stone,[150] and others). An analysis of the various hormone tests for pregnancy that have been advanced in recent years has been conducted by Mazer and Hoffman,[114] but their results with the Aschheim-Zondek method have not been as promising as those of other workers. Stern[149] has sounded a warning regarding possible social abuses with resultant legal complications following the injudicious use of the test, and this has called forth an editorial comment in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY.[35]

Cole and Hart[21] have shown the presence of large amounts of APH in the blood of mares in early pregnancy, and this has been corroborated by Zondek[169] who also found that the urine of these animals shows APH-A but no APH-B. Ehrhardt[36, 37, 38] found that a positive Aschheim-Zondek reaction can be obtained from the urine of patients following a blood transfusion from a pregnant donor. The excretion of the hormone is so rapid that in one case this occurred ten minutes following the transfusion. Although Ehrhardt and Zondek maintain that a positive reaction may be obtained from the urine of pregnant monkeys, Allen, et al.,[1] failed to demonstrate any ovary-stimulating substance as a result of 12 tests in one animal.

The Aschheim-Zondek test has been recommended as a valuable procedure for the diagnosis of hydatidiform mole and chorionepithelioma by Rössler,[138] and his findings have been corroborated by numerous observers (Fels,[55] Otto,[123] Schultze-Rhonhof,[141] Mack and Catherwood,[107] Ehrhardt[39, 40] Fanz and Gault,[52] Fahlbusch,[51] and Haupt.[78] In these cases the reaction is much more intense than during pregnancy, and remains positive in the presence of metastases from a chorionepithelioma or when small fragments remain after a curettage for hydatidiform mole. It may thus be used to advantage in successfully controlling the treatment of such patients.

A number of important modifications in the technic of the test have been reported. Zondek[166, 167] has described a method consisting of a concentration of the urine by precipitating with alcohol and detoxicating with ether, and Eberson,[33] and Eberson and Silverberg[34] reported 100 per cent correct results and a speeding-up of the time required for the test by the use of a similar procedure. Böhne[8] has made cultures from the urine of pregnant women, and stated that the detoxication by ether which Zondek advocates is due to the fact that ether kills harmful bacteria present in the specimens. Brouha, Hinglais, and Simmonet[11] used male mice as test animals and noted the weight of the seminal vesicles and the testicles as criteria, but Kraus[102] questioned the efficacy of this procedure as a pregnancy test. Considerable interest was aroused by reports of a cutaneous reaction with Prolan as a means of diagnosis for early pregnancy, but recent studies are not encouraging (Porges and Pollaczek,[132] Deutsch,[30] Strauss[151]). Zondek[168] has directed attention to an interesting procedure which is used for the determination of the presence of ovary-stimulating substances in tissues and discussed its importance in the differential diagnosis of chorionepithelioma.

Zondek[163] has described the effects of Prolan injections in rabbits, while Friedman[67, 68] demonstrated the rapidity by which ovulation

may be induced in this animal by the intravenous administration of small amounts of urine from pregnant women, and this procedure now bids fair to supplant the Aschheim-Zondek test for general laboratory usage. It is simple of execution, a result may be obtained in thirty hours, no microscopic sections are essential, and preliminary reports seem to vouch for its accuracy (Schneider,[139, 140] Friedman and Lapham,[69] Reinhart and Scott,[135] Magath and Randall[108]).

6. ANTERIOR PITUITARY HORMONE TESTS IN NONPREGNANT CONDITIONS

Although the Aschheim-Zondek test has been used principally for the early diagnosis of pregnancy, it may find its application in the study of various endocrine conditions. Fluhmann[60, 61] has used the test to study the presence of APH in the blood and has found that it is consistently negative in women with normal menstruation, and in patients with "hypo-ovarian" conditions, as manifested by short periods of amenorrhea, scanty irregular menses, or persistently delayed menses. On the other hand, positive tests were obtained in three groups, (a) during pregnancy, when the test is characterized by APR II and III, (b) in the presence of a total ovarian deficiency (following complete operative extirpation of the ovaries, after radiation castration, in the postclimacteric, and in a number of women with prolonged periods of amenorrhea), when the test gave mainly APR I but also occasionally APR III, and (c) in a smaller group composed of women with irregular profuse periods at the time of the menopause, and in younger patients with too profuse and too frequent menses, when APR I was found. On the strength of these findings in nonpregnant individuals, Fluhmann[62] suggests a clinical grouping based on ovarian function as determined by the history of the menstrual cycle. In the first two groups (1. normal ovarian function; 2. hypohormonal conditions) the test has proved consistently negative, while in the other two categories (3. afunctional conditions; 4. hyperhormonal conditions) a high percentage of positive tests are found. Zondek[170] has also obtained positive results (APR I) with the blood of a few women with marked ovarian deficiency, and further confirmation has been advanced by Mazer and Hoffman.[114] In a recent preliminary communication Frank, Goldberger and Spielman[65] described a method of concentrating larger amounts of blood by which they have been able to obtain an APR I during the normal menstrual cycle. They have found the strongest reactions from the sixth to the ninth days of the cycle, and believe that approximately 25 mouse units per liter is the maximum amount of "Prolan A" in the circulation of the normal nonpregnant woman.

Zondek[164, 165] has reported that APR I is also obtained from the urine of women at the time of the climacteric, following castration, and in patients with genital carcinoma, while Neumann[121] has found the same result with the urine of children up to the age of ten.

7. THE USE OF OVARY-STIMULATING SUBSTANCES FOR THERAPEUTIC PURPOSES

Of special importance to the practitioner is the possibility, arising from this work, of obtaining an ovary-stimulating substance which may be employed for the treatment of amenorrhea, delayed menses, scanty menstruation, and sterility. This work must be considered as still in the experimental stage but it is of interest that investigation

along this line is proceeding hand in hand with the physiologic studies. The extracts at present in use therapeutically are either made from the urine of pregnant women, as for example, Prolan, or from the placenta, as Emmenin.

Encouraging results in the treatment of so-called "hypo-ovarian" conditions from the use of the German preparations Prolan, Prehormone and Homhormone, have been reported by Zondek,[170] Seitz,[142] Hirsh-Hoffman and Wulk,[86] and Koehler.[98] Zamkoff[162] has also had very encouraging experiences from the use of urine from pregnant women, and good results from the injection of whole blood or blood serum from human pregnant donors have been reported by de Maortua[111] and Esch.[50] Zondek[170] has employed Prolan for the treatment of pelvic inflammatory disease in view of his previous observation that the administration of this extract causes a local increase of temperature, and believes that in association with bed-rest this method of therapy is highly commendable. This contention is supported by Montag,[117] but on the other hand an adverse report has been given by Bauer and Lehfeldt,[6] who in addition failed to obtain successful results in 10 cases of menstrual disturbances attributed to ovarian dysfunction. Fellner[54] believes that Feminin is preferable to anterior pituitary hormone from a therapeutic standpoint in view of the danger of injury to the ovaries. Martin[113] has successfully used Prolan in high doses for patients with intractable menorrhagia, and suggests this as a possible means of producing a hormonal castration.

The treatment of 135 cases of deranged ovarian function by the oral administration of the placental extract Emmenin has been reported by Campbell and Collip.[15, 16] These authors note unsatisfactory results in the treatment of primary amenorrhea, but find a high percentage of patients with improvement in cases of secondary amenorrhea, oligomenorrhea, dysmenorrhea, polymenorrhea, and menopausal symptoms. They have also obtained an arrest of the bleeding in certain forms of menorrhagia and metrorrhagia by the hypodermic administration of Collip's "anterior-pituitary-like" placental extract.

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Stanford University Hospital.

Items

American Board of Obstetrics and Gynecology

The following names are announced by the American Board of Obstetrics and Gynecology as having been Certified:

Bourland, J. W.	Dallas, Texas
Crossen, H. S.	St. Louis, Mo.
Dorland, W. A. N.	Chicago, Ill.
Falls, F. H.	Chicago, Ill.
Flint, Austin	New York City
Halsted, Harbeck	New York City
Hanna, M. A.	Kansas City, Mo.
Harrar, J. A.	New York City

HILDRETH, WARREN	NEW YORK CITY
HINKLE, S. B.	LITTLE ROCK, ARKANSAS
HOLDEN, F. C.	NEW YORK CITY
HOLLADAY, E. W.	NEW YORK CITY
PRIDE, W. T.	MEMPHIS, TENN.
RICE, F. W.	NEW YORK CITY
TAYLOR, H. C.	NEW YORK CITY
WOLFE, S. A.	BROOKLYN, N. Y.

Written Examination for Group III Applicants

The written examination for Group III applicants for Certificate from the American Board of Obstetrics and Gynecology, held on October 31, 1931, consisted of the following questions:

1. Describe the pelvic lymphatics and discuss the clinical value of a knowledge of their distribution.

2. What is the relation of the corpus luteum to menstruation?

3. Describe the pathology of carcinoma of the uterus.

4. Describe a biological test for the diagnosis of early pregnancy.

5. What factors determine normal internal rotation in vertex presentation?

6. Discuss the diagnosis of trichomonas vaginalis vaginitis and outline the treatment of such a case.

7. Describe your treatment of incomplete abortion; (a) afebrile, (b) febrile.

8. Given a woman, not in labor, seen by you for the first time, with convulsions, blood pressure 220/120, and albumin plus 4, how would you treat her?

9. What are the indications for myomectomy?

10. Describe briefly the technic of your favorite operation for the correction of retrodisplacements of the uterus, and state reasons for your preference.

This examination was held simultaneously in 18 different cities of the United States and Canada. The clinical examination for all applicants (Groups II and III) will be held in the Department of Obstetrics and Gynecology, University of Chicago on December 29, 1931. Approximately forty applicants had qualified for this examination at the time of receiving notice from the Secretary. For further information and application blanks please apply to the Secretary, Dr. Paul Titus, 1015 Highland Building, Pittsburgh, Pennsylvania.

Professor M. G. Serdukoff, Director of the Moscow Regional Research Institute for Maternal and Infant Welfare, is preparing a contemporary monograph with an appendix of literary references on cancer of the female genitalia. This subject is being specially studied at the oncologic section of the clinic. Professor Serdukoff therefore appeals to all authors having at any time written anything on this topic (operations, biology, pathology, medical treatment, information on organization questions, etc.) to kindly forward to him reprints of monographs, reports, or any other material.

All publications to be addressed as follows: Moscow, Piatnitzkaia, 65, App. 16. Prof. M. G. Serdukoff.